WIRED

October 1997

Computer Games:
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Dawn of the
Hydrogen Age

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Hack the Genome

The Crypto War's
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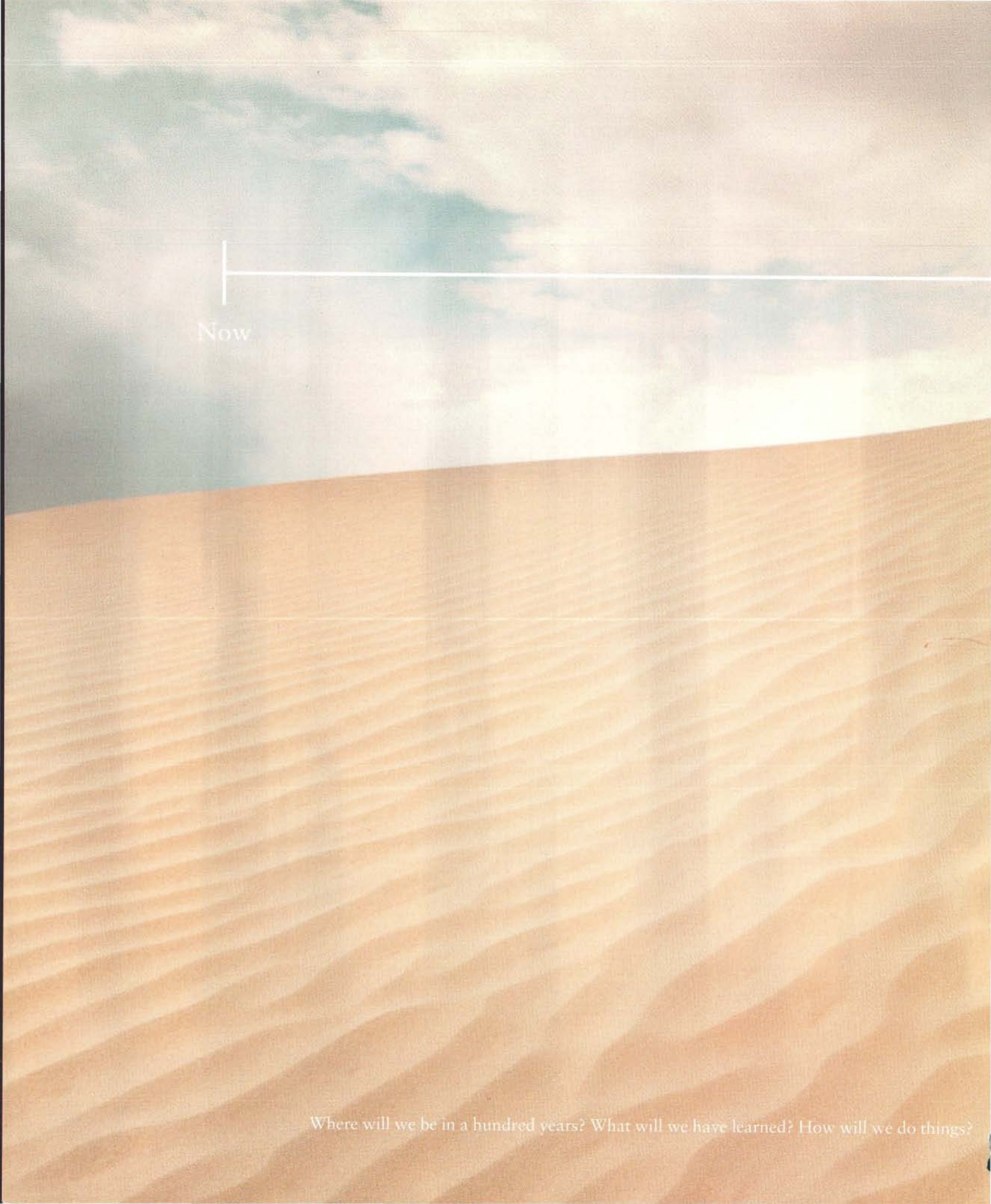

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Bruce Gifford

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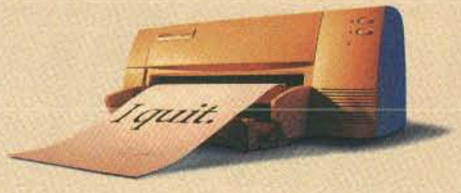

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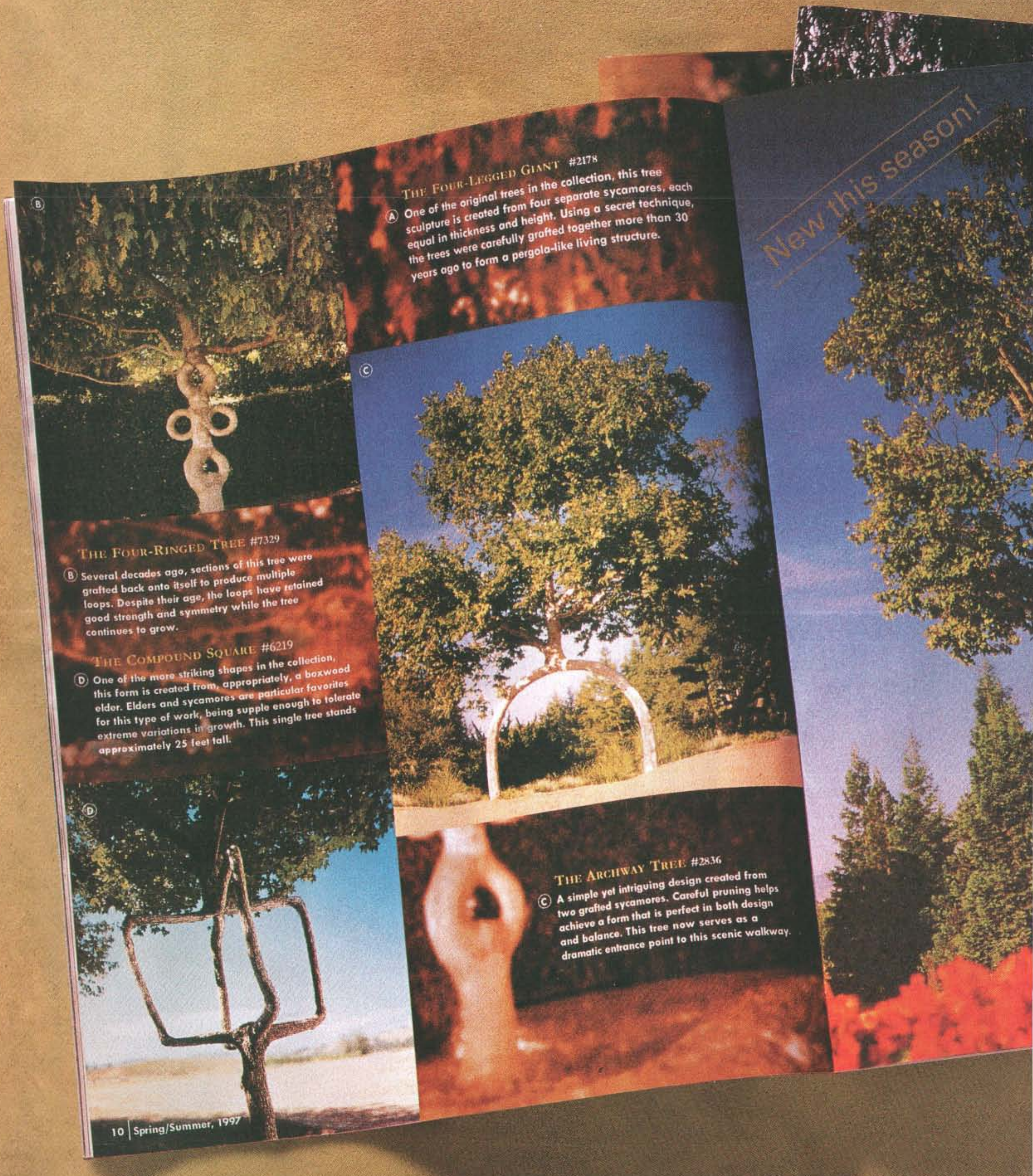

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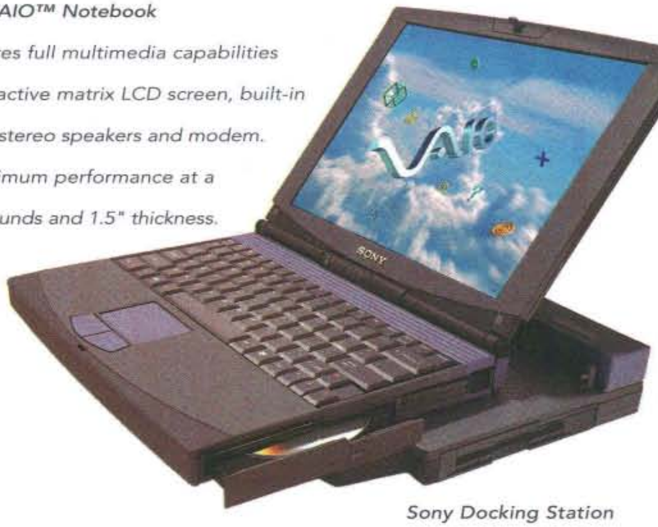

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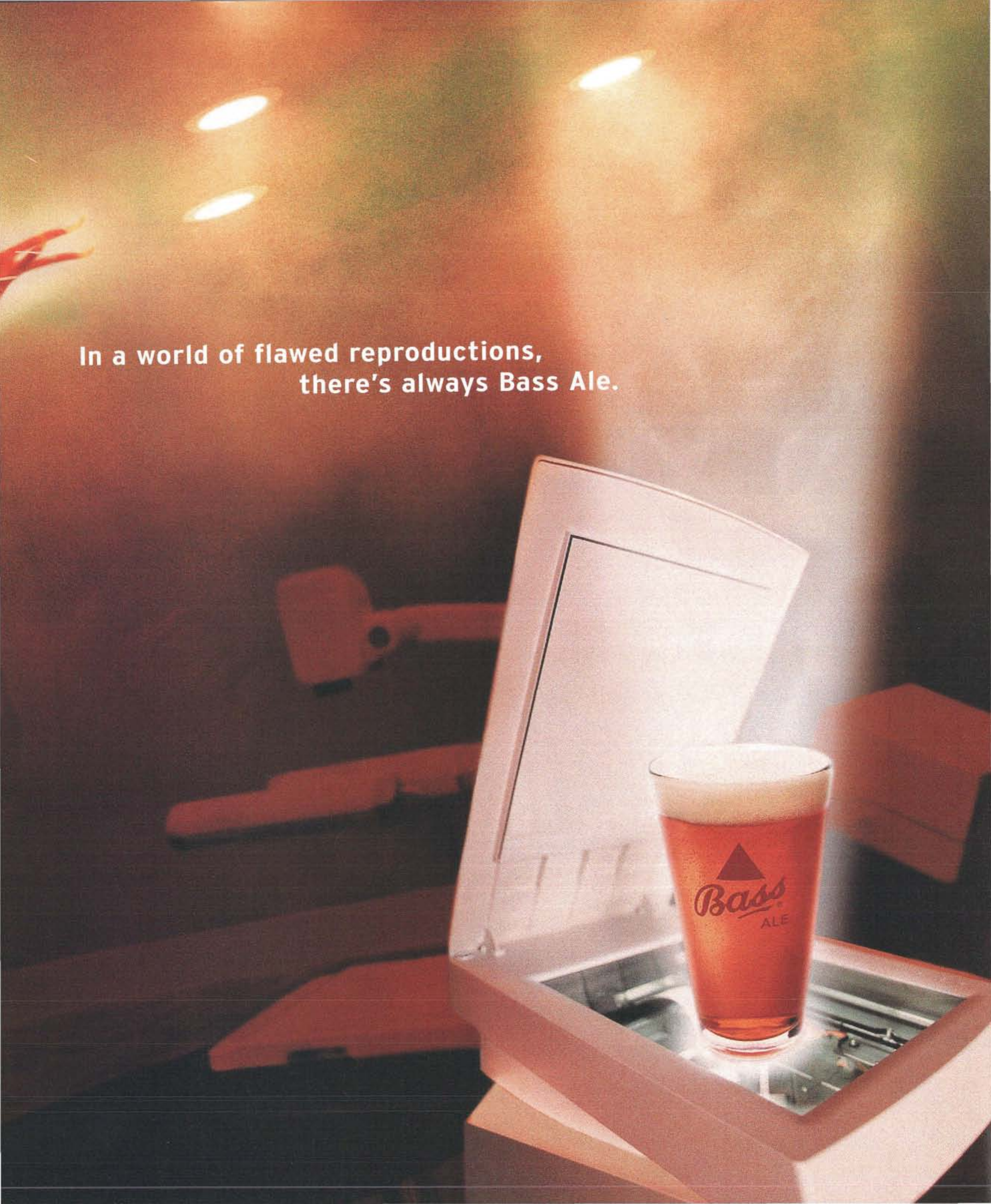
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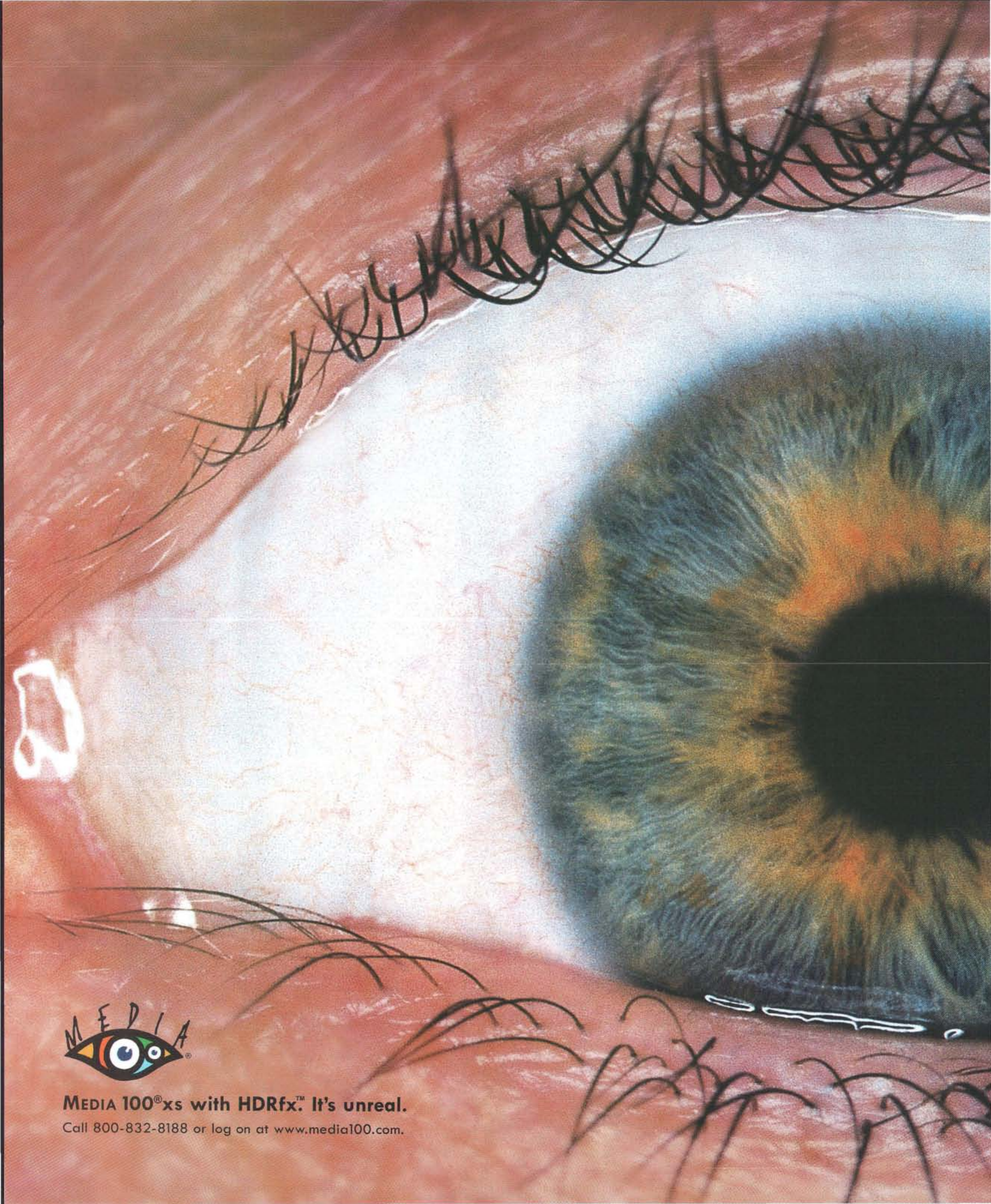

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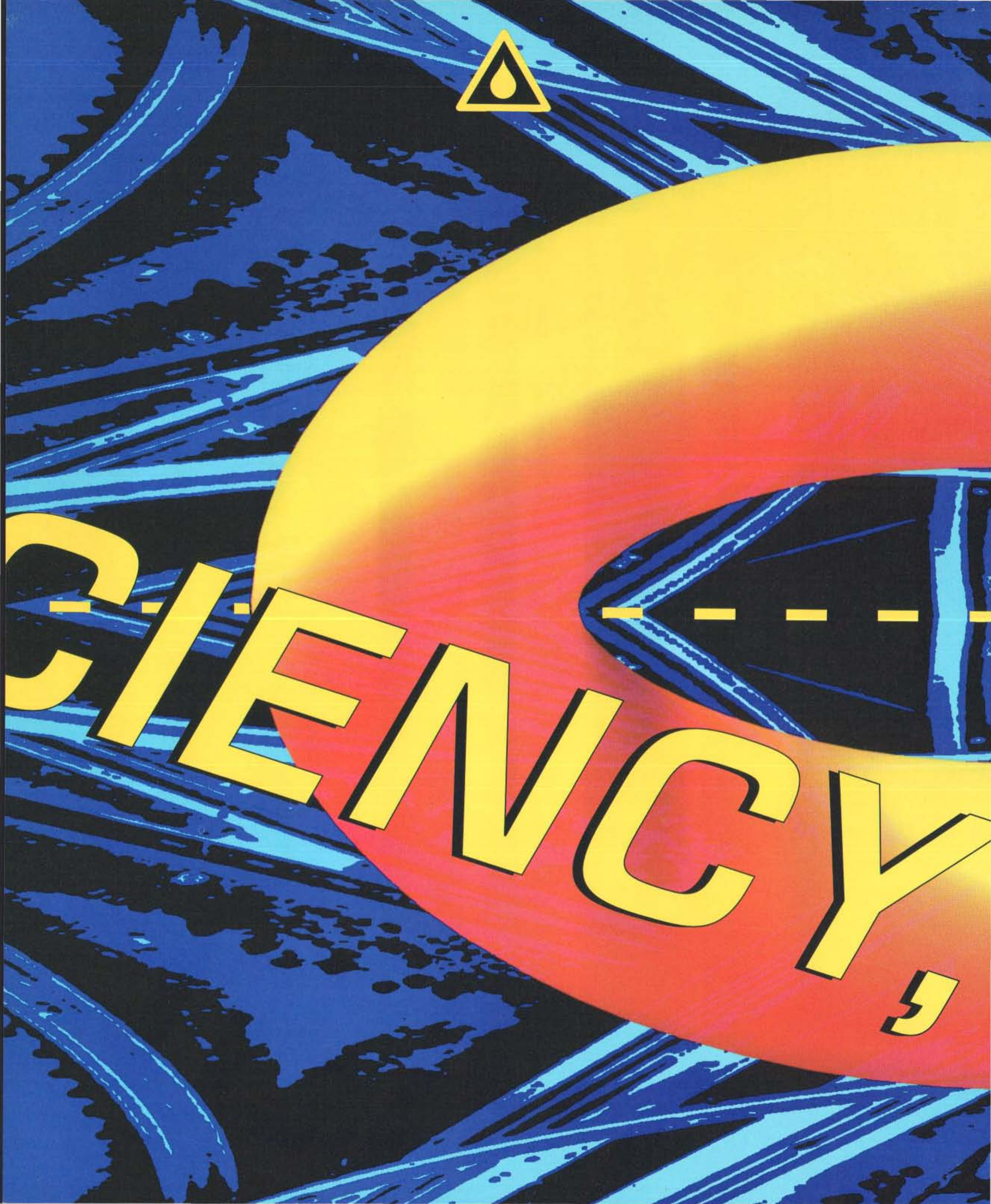

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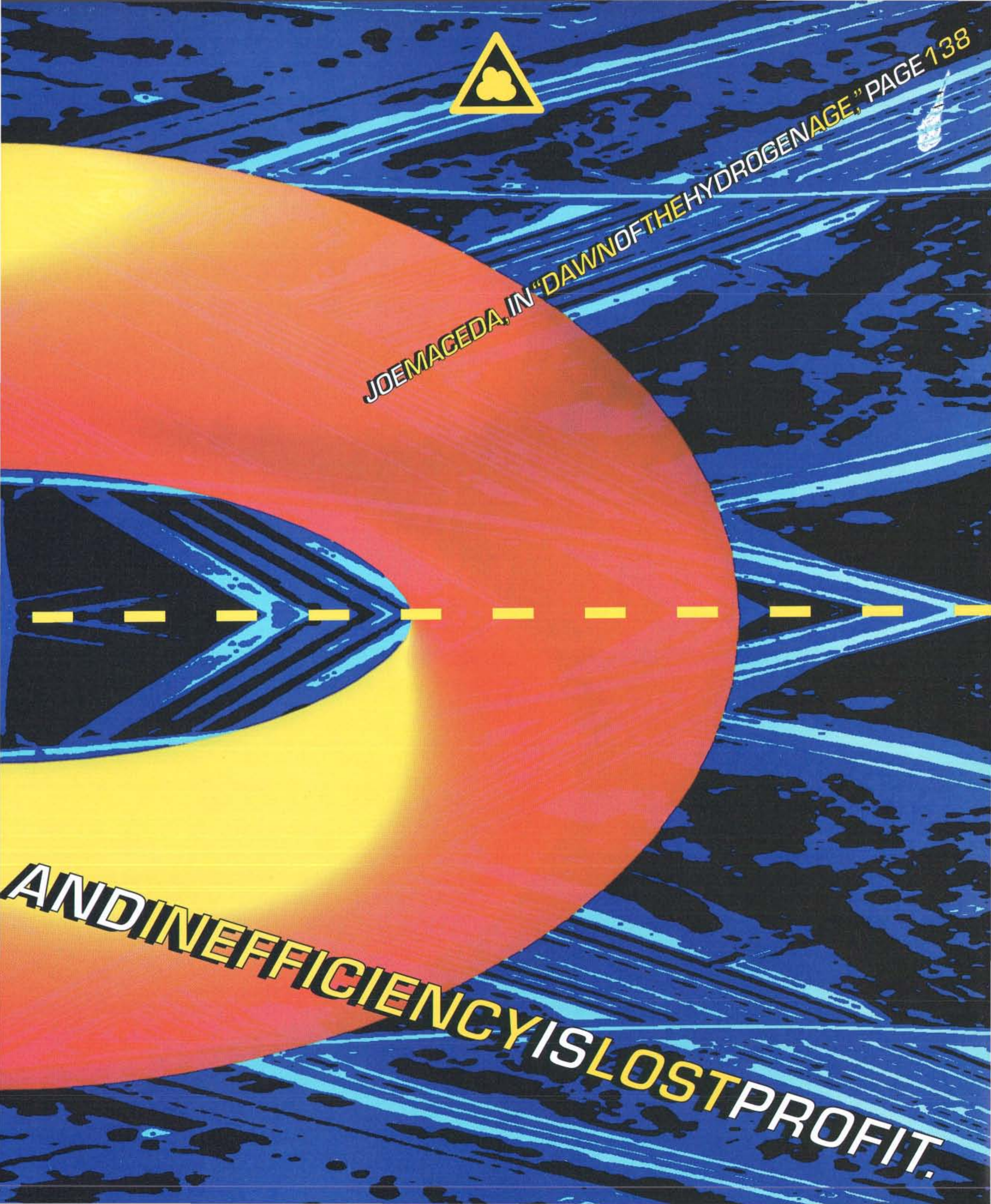

JOE MACEDA, IN "DAWN OF THE HYDROGEN AGE," PAGE 138

AND INEFFICIENCY IS LOST PROFIT.

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Rob Glaser's RealVideo and his recent deals with MCI and Microsoft promise to transform the Net – and transform his company, Progressive Networks, into a kingmaking Internet powerhouse.

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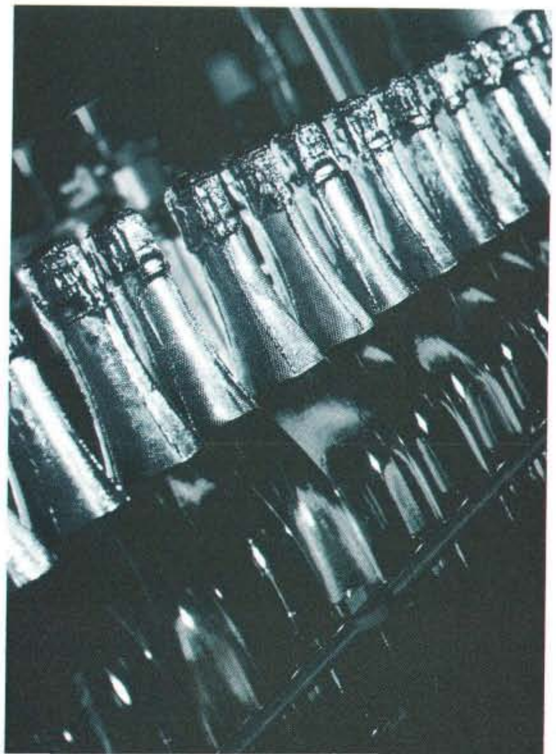

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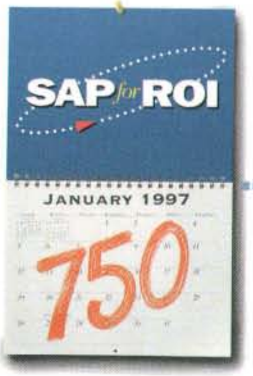

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1997

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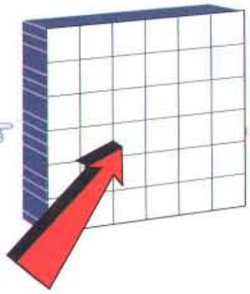

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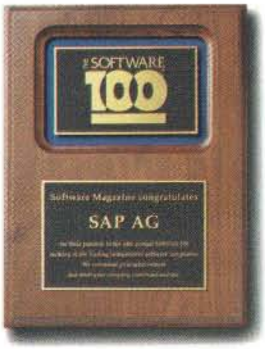

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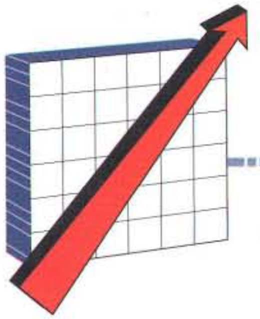

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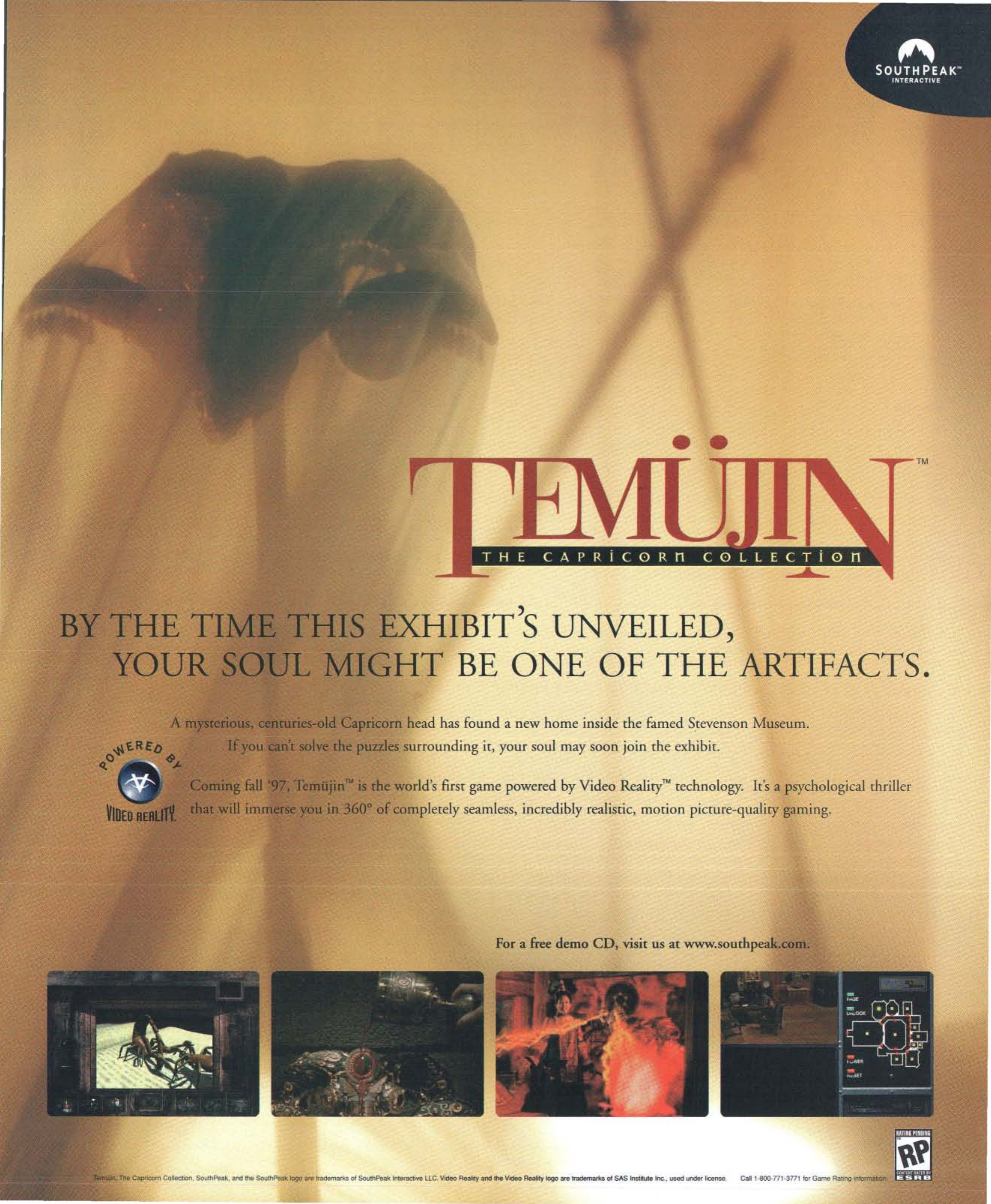

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Boom Bloom

I hope you're right about the Long Boom (*Wired* 5.07, page 115). But doesn't it strike you that the assumption that openness, multiculturalism, and hybridity are good – an assumption critical to the success of your Long Boom – is itself an ethnocentric product of a Western liberal-democratic worldview? Would such ideas ever arise independently in a Confucian culture or a fundamentalist Islamic society?

Not that I think those values are bad – just the opposite, in fact. They're great values. Moreover, they're *my* values. But I do think that Peter Schwartz and Peter Leyden's boom might be perceived by many people as the triumph of values belonging to a given culture rather than an idyllic conversation among civilizations.

The challenge is to give people from Albania to Zimbabwe a stake in the creation of such a civilization, despite the real and irreducible differences in their own beliefs and values, rather than leaving them with the feeling that the Long Boom has been shoved down their collective throat.

But, hey, as for me – where do I sign up?

Adam Greenfield
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I read "The Long Boom" with great interest and appreciate its Tofflerian worldview. Few utopian perspectives, however, address the mental strain of accessing, filtering, processing, and retaining the onslaught of knowledge-information overload.

As we approach critical mass in our ability to cope with the related info-stress, it is easy to feel that we are each alone and treading water in a tsunami of must-know-to-be-current-and-hip data. Acknowledging, reconnecting, and living with the oneness honored in most spiritual paths allows us to flow with the tide – to truly be data surfers.

To paraphrase many a sage, the digital era is, to date, largely an exercise in "doing." Our psychological survival in these frenzied advances – and the other issues of the new millennium – rests instead in our way of being with it all. In technology, as in all walks of life, this distinction makes the difference between a stressful, obligatory challenge and a joyous, empowered journey.

Jeff Burger
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I must take serious exception to Peter Schwartz and Peter Leyden's claim that Alan Greenspan's retirement will be a good thing. Greenspan's retirement should be viewed as a serious risk factor, not as an opportunity for unbridled prosperity.

During his tenure as chair of the Federal Reserve, the US economy has experienced a remarkable period of monetary and price stability that has made possible the boom of the '90s. This "Goldilocks economy" – not too hot, not too cold – is engineered to enable sustained economic growth without the wild ups and downs that characterized the American business cycle in the '70s and '80s (and still persist in economies around the world, including many in Asia).

The benefits of this stable platform for growth are often underestimated, but to the business planner it is as important as reliable communications, power, and transport. It is particularly important in the US because of the dollar's special status as the de facto global currency. Ordinary citizens benefit most of all: we don't have to worry about losing our savings to inflation. In today's economy, there are jobs available for even the least skilled, with real wages rising again. We can only hope that Greenspan's successor will be as effective as he has been.

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What a wonderful world it's going to be – provided, of course, that all of it comes true.

Although the article touched on important aspects of global transition, it skimmed over agriculture. Urban sectors of society will continually compete for water, since irrigated agriculture consumes 80 percent of water resources in an average agricultural/metropolitan region.

An expanding industry is drip irrigation, or microirrigation. This process saves water, reduces fertilizer consumption, and assists farmers during drought periods. Microirrigation will become a bigger player in states such as California where urban sprawl will gobble up prime farmland, no matter how rosy the scenario. It has helped transform countries like India from food importers just a generation ago to food exporters today.

While I was a soil scientist at the US Department of Agriculture's Agricultural Research Service, I initiated an Internet discussion list focusing on microirrigation. Today, that list has grown to 600 subscribers in 32 nations. Individuals in developing countries with Internet access are tapping in to this list of experts and industry reps and discovering that online answers are quick and the information is deep. I can only imagine what things will be like in agricultural technology in 20 years.

Richard Mead
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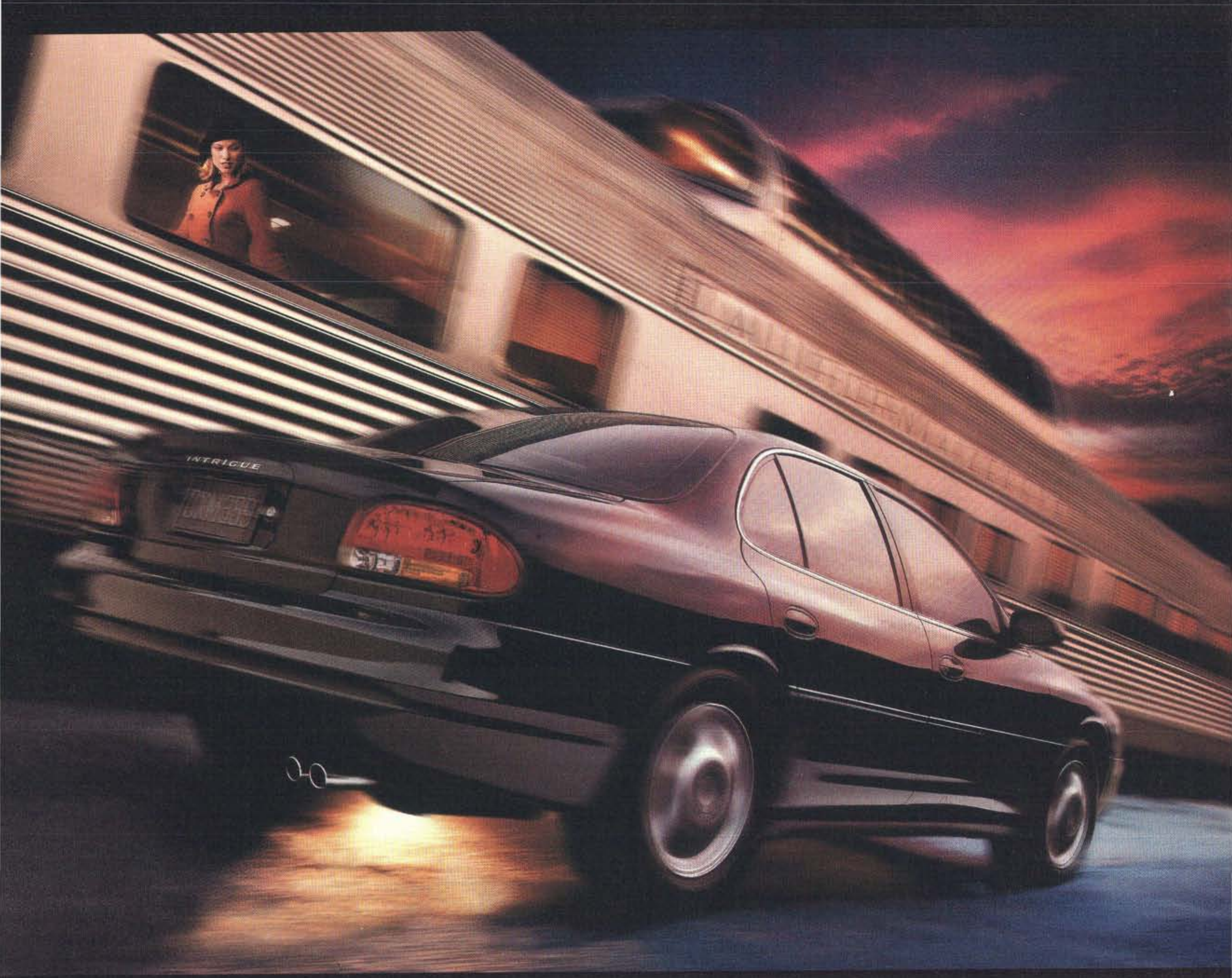
Wired's time line of the future predicted that early hydrogen cars would appear around 2007. Ballard Power Systems in Burnaby, British Columbia, has

IMAGE: GEORGE SANDOVAL



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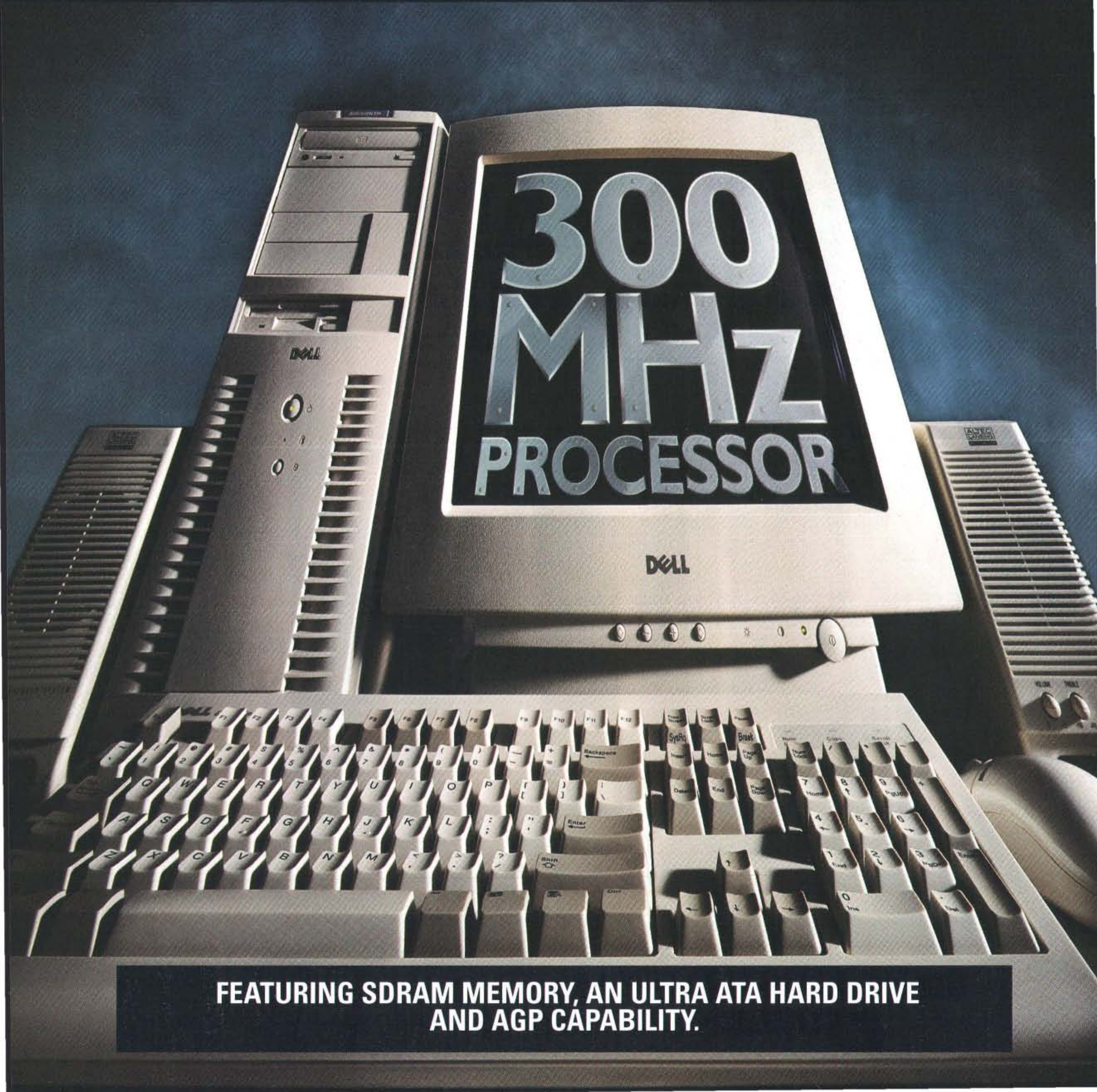
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already developed a completely hydrogen-powered bus, though it is not yet commercially available. No gas, no emissions, just clear drinkable water coming from this rig's tailpipe. Hydrogen can be a clean, cheap, alternative energy source.

As of late, Ballard also has been working with companies like Ford and Daimler-Benz to produce a methanol-powered car. There is a very good chance that we will be able to drive home in one before the century is out.

James Strocel
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See "Dawn of the Hydrogen Age" in this issue of Wired.

Cemex's Success

The neat thing about seeing complexity theory in action ("Bordering on Chaos," *Wired* 5.07, page 98) is that Cemex uses the common law (which permits what it doesn't prohibit) to create great new operating procedures in a country that uses the Roman law (which prohibits what it doesn't permit).

Of course, applying free-market management in firms typically produces the kind of results that can grow a tiny business to the world's third-largest cement company in a decade.

Cemex's top execs and engineers use the conversation to make commitments. This style is more than just the right way to implement technology; it's the right way to run a business or a society. You create an architecture of human behaviors when employees can make commitments that satisfy their clients. To succeed, companies must empower employees, since each worker knows his own client's needs and wants best. That's a big change from Mexican tradition.

Cemex operates in a country that empowered the politicians and the bosses, but never the clients and the employees – until Lorenzo Zambrano came along and turned the world upside down.

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Spam Scam

Brock N. Meeks's article on antispam legislation ("Stomping Out Spam," *Wired* 5.08, page 82) fails to address the most critical issue for many people: cost-shifting. Traditionally, the cost of advertising is paid by the advertiser, and in many media subsidizes the cost to the consumer. Advertising, for example, keeps television free and newspapers cheap.

This economic model does not apply to spam. Instead, the advertiser pays a fraction of what it would pay for a traditional marketing campaign, and the recipient pays to pick up the pieces. Spam clogs networks, delays mail, takes down servers, and dominates administrator time. All that raises your ISP's operating costs – costs that ultimately trickle down to the consumer in the form of increased fees.

This is important, because no scheme that involves recipient-level mail filtering really addresses the cost-shifting issue. Any solution that permits spammers to send out advertisements, requiring them merely to adopt a content-tagging system and honor unsubscribe requests, won't have a significant effect on the amount of spam received by a service provider, and therefore will not reduce the ISP's costs or yours. Neither Senator Robert Torricelli's nor Senator Frank Murkowski's bill will have much effect on the additional costs borne by consumers.

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Brock N. Meeks selects Senator Torricelli's Electronic Mailbox Protection Act of 1997 as the most "Internet-friendly" of the three pieces of upcoming antispam legislation. I disagree. Torricelli's bill prohibits spammers from using false From addresses, creating new domain names, or moving operations overseas. Speaking in terms of the Constitution, it is difficult to justify imposing these restrictions on spammers and not on any other Internet user (let alone preventing private business from moving overseas). Or does Torricelli plan to restrict everyone? It doesn't sound very Internet-friendly to me.

Representative Chris Smith's amendment to the Consumer Protection Act of 1991 is much more respectful of cyber rights. It would merely treat junk email as junk faxes are treated. The ban on junk faxes was upheld in court because, although the advertising is a form of speech, the recipient must pay for an unwanted message. Email isn't free, either – even if an Internet user doesn't pay for his spam with an hourly rate, his ISP spends money to make the connections happen. And although the courts have ruled that the Internet differs from the phone system, junk email is just as unwanted as junk faxes.

Smith's bill will be more effective than Torricelli's, simpler, and – more important – less intrusive, in a domain where intrusion is death.

Jonathan R. Schwanbeck
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Librarian Longevity

I enjoyed "Morphing the Librarians" (*Wired* 5.08, page 64). As a librarian, I am thrilled at the changes my profession is going through.

Indeed, far from swapping public service for money and power or even becoming extinct, many of us in public libraries find ourselves busier than ever. In Augusta, Maine,the staff at Lithgow Public Library serves its clientele with an online public catalog and an interlibrary loan system dependent on email and listservs. We answer many reference questions using the Internet and CD-ROM sources.

We train library users to answer their information and entertainment needs using technology. Public libraries are in the unique position of being able to offer high tech services and training to everyone, even those who cannot afford a computer at home or have never touched a computer before.

It is extremely gratifying to see the light and excitement in someone's face when they grasp the wealth of free information at their fingertips. Technology is a happy extension of the public service we have been providing all along.

Jodi Johnson
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Don't buy the extinction myth. Educated and trained librarians will be needed to help users sift through and locate appropriate information regardless of format. A number of students come to the library to find specific information and haven't the foggiest idea how to do it.

This profession has changed rapidly over the last decade. The profession isn't ruled by the Dewey Decimal System (ever hear of the Library of Congress?), it is ruled by a desire to meet users' needs, whether by modern or traditional methods.

We will survive!

Tracey Cuellar
tcuellar@campus.mainland.cc.tx.us

Integrationist Integrity

How delightful that the wired world is so fabulous and that Larry Summers is leading the charge to a bold new land of prosperity and retro-smiling faces ("The Integrationist vs. the Separatists," *Wired* 5.07, page 53). Why, with my Pentium Pro 200 MHz surfing the Club Med homepage while downloading my soon-to-be-decimalized-8,000-Dow-make-me-snappy-happy fund closing price, I, too, can close the door on reality and drive into *Wired*'s perfect future.

Needless to say, we must not slow down to note that the United Nations Development Program just reported that 19 percent of Americans live in poverty. Nor should we consider that Summers and his ilk don't give a hoot about the distribution of wealth, only the abundance of it for some.

The editors of *Wired* and Summers should take a look at the living conditions of the 1 billion people who have access to just a fraction of the wealth they describe before judging the planet's future so rosy. There is a lot we can do to bridge the gap between rich and poor. Technology can play a vital role in the struggle for justice, while arrogance has no role in our quest for survival.

Nick Morgan
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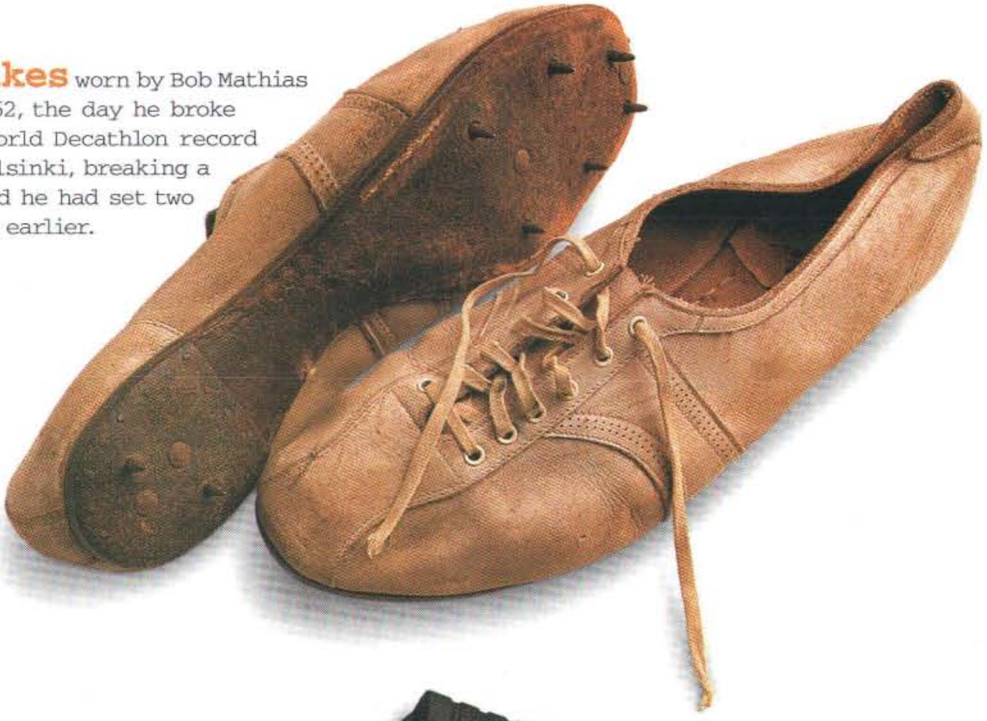
Déjà Vu

The article on ImageCensor ("The Unpeep Show," *Wired* 5.06, page 48) dredged up memories of high school. The art history teacher at my school was

Spikes worn by Bob Mathias in 1952, the day he broke the World Decathlon record in Helsinki, breaking a record he had set two years earlier.



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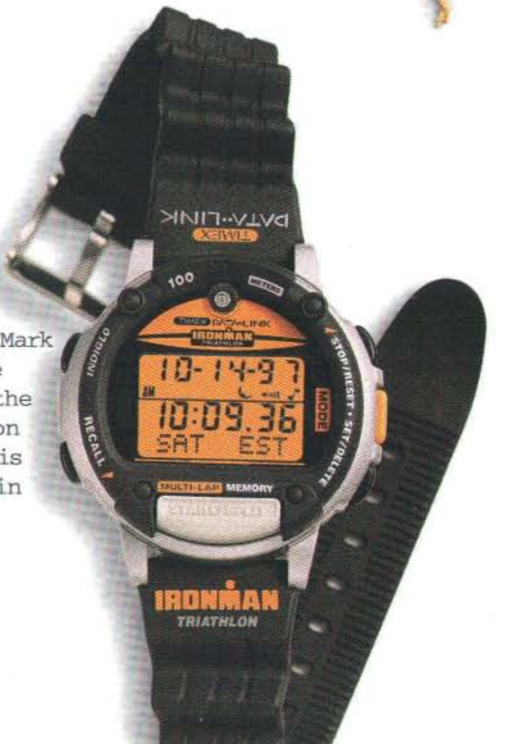

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often quite pissed off when the librarian took it upon herself to censor expensive and lavishly illustrated art books. Like Zorro making his mark, she would hide the naughty bits behind indelible black ink, leaving us prepubescent lads to fantasize over what we were missing. The reproduction of Titian's *Venus of Urbino* happened to be one of the great nude victims that suffered at the hands of our illustrious librarian. With ImageCensor, we've rubbed out the middleman or -woman, and many will never know what's been blocked.

E. Killinger
Hogansville, Georgia

Nit-PICSing

PICS is designed such that its code must be embedded into the actual HTML file – a part of the page's guts ("Tyranny in the Infrastructure," *Wired* 5.07, page 96). It would be impossible to enforce its insertion into each of the 80 million or so existing Web pages, rendering PICS just another sparsely used ratings system – not the "devil" of content blockers, as Lawrence Lessig fears it to be.

Nathaniel Swinburne
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Digital Obesity

In "Digital Obesity" (*Wired* 5.07, page 188), Nicholas Negroponte slams Microsoft and others for issuing increasingly complex software and upgrades. He's right, but he fails to offer the obvious reason the behemoths should care what we think: more – and happier – customers. If Redmond and Silicon Valley weren't so esoteric and arrogant, they might just develop an easy-to-use computer for the uninitiated. And that's quite a market.

Chris Avery
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Killer Apps

The killer app Oliver Morton alludes to in "Private Spy" (*Wired* 5.08, page 114) requires one crucial component not mentioned in the article – elevation post data over which the 2-D images can be draped. Combining elevation information with satellite imagery for real-time visualization on a PC with inexpensive graphics accelerators will open up vast markets. Gamers can choose to play in real virtual worlds, while builders and real estate agents can walk through housing developments anywhere in the world. The killer app will be free, and the imagery and elevation data will be accessible over the Web for nominal charges.

W. Garth Smith
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Freedom to Connect

I found *Wired*'s map of Net access to be arbitrary, at best ("Freedom to Connect," *Wired* 5.08, page 106). While I agree that there are immoral restrictions on free speech in countries that usually claim to be more enlightened – like the US, the UK, and Germany – I find your ignoring of privacy (encryption) rights violations in France, Spain, et cetera, to be highly myopic. A privacy battle is being fought worldwide at the moment. It is extremely important that these human rights violations not be ignored.

Don Heinz
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Despite her work in compiling a large number of sources, Leila Conners made several mistakes in "Freedom to Connect." The geographical borders of the new Yugoslavia were shown incorrectly, dividing the nation into four regions according to the local county lines. (Why didn't you divide Switzerland into cantons or the UK into counties?) The legend indicated that Internet access is not available in Serbia. That is definitely not true, and it has not been true for the last two years.

I am surprised that *Wired* ran this piece, when a long article about Yugoslavia and cyberspace was published in April ("The Internet Revolution," *Wired* 5.04, page 122).

Tadija Janjic
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The Yugoslavia that existed before the civil war is no longer. It has been broken into other sovereign entities. Croatia and Bosnia are not equivalents to Swiss cantons or counties in the UK; Wired *did not make a mistake in the map's boundaries.*

At the time the survey was conducted, because of disruption caused by the war, Serbian embassy sources did not guarantee connectivity. Things change rapidly, and the next map will reflect those changes, including the Serbian experience. – Leila Conners

Power to Consume

James Ogilvy's "The Power to Consume" (*Wired* 5.07, page 110) was so fallacious, it is difficult to know where to begin. By focusing on the global system, which must balance consumption and production, he ignores the fact that there is competition within that system. The winning companies, nations, and individuals will be those that consume less, produce more, win the battle for limited markets, and invest the difference (never mind the fact that it's not possible for everyone to do so).

He complains about limits in purchasing desire. And yet, if everyone were to reach a point where they have everything they want, we would finally have achieved true wealth as a society. Economics would be more rational if it measured contentment as well as dollars.

Ogilvy shouldn't feel bad. The myth that consumption produces wealth for the consumers is a pervasive one in modern economics. It is a myth that keeps the majority of our population on an endless treadmill of consumption and dissatisfaction, while the wise minority save their money, wake up millionaires one day, and retire in Maui.

Dennis Peterson
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Cyber Age or Dark Age?

Perhaps the title of Lynn Ginsburg's interview of Carl Malamud ("The Contrarian Libertarian," *Wired* 5.07, page 130) should have been "Contrarian to Logic and Good Sense." According to Malamud, cyberspace should not be considered any differently from the real world with respect to the law and government. To which law and government is he referring? Maybe China's or Iraq's? Is he confusing the cyber age with the Dark Ages? Malamud trips over his own logic and proves himself to be a poor advocate of free speech online (or anywhere) with his statement that "spamming and emailing ought to be crimes" and that one "ought to be able to call the police and have (perpetrators) arrested." In the physical world, spammers are the folks who clutter our mailboxes with sometimes unwanted solicitations. Should we be able to march down to the magistrate's office and file charges against them, too?

Victor Cuco
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Workers' Party

In Electric Word (*Wired* 5.08, page 42), Tang Liang Hong is described as a "People's Action Party member." Tang ran on the Workers' Party slate in the 1997 general election. The People's Action Party (PAP) has been the ruling party in Singapore since 1959 and is the party of Prime Minister Goh Chok Tong. I presume that Tang would resent being associated with the PAP, rather than the Workers' Party, which is the primary opposition party in Singapore.

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mulliner@eurekanet.com

Undo

School of Hard Knoxville: Bill Gates's worst nightmare, Gary Reback ("The Robin Hood of the Rich," *Wired* 5.08, page 108), was born in Knoxville, Tennessee. ▪ Photographic Memory: The photograph accompanying the review of the SideWinder 3D Pro joystick ("Straight up, with a Twist," *Wired* 5.07, page 161) was actually Microsoft's SideWinder Force Feedback Pro. ▪ Special Thanks: Jess Bragg contributed to "101 Ways to Save Apple" (*Wired* 5.06, page 114).

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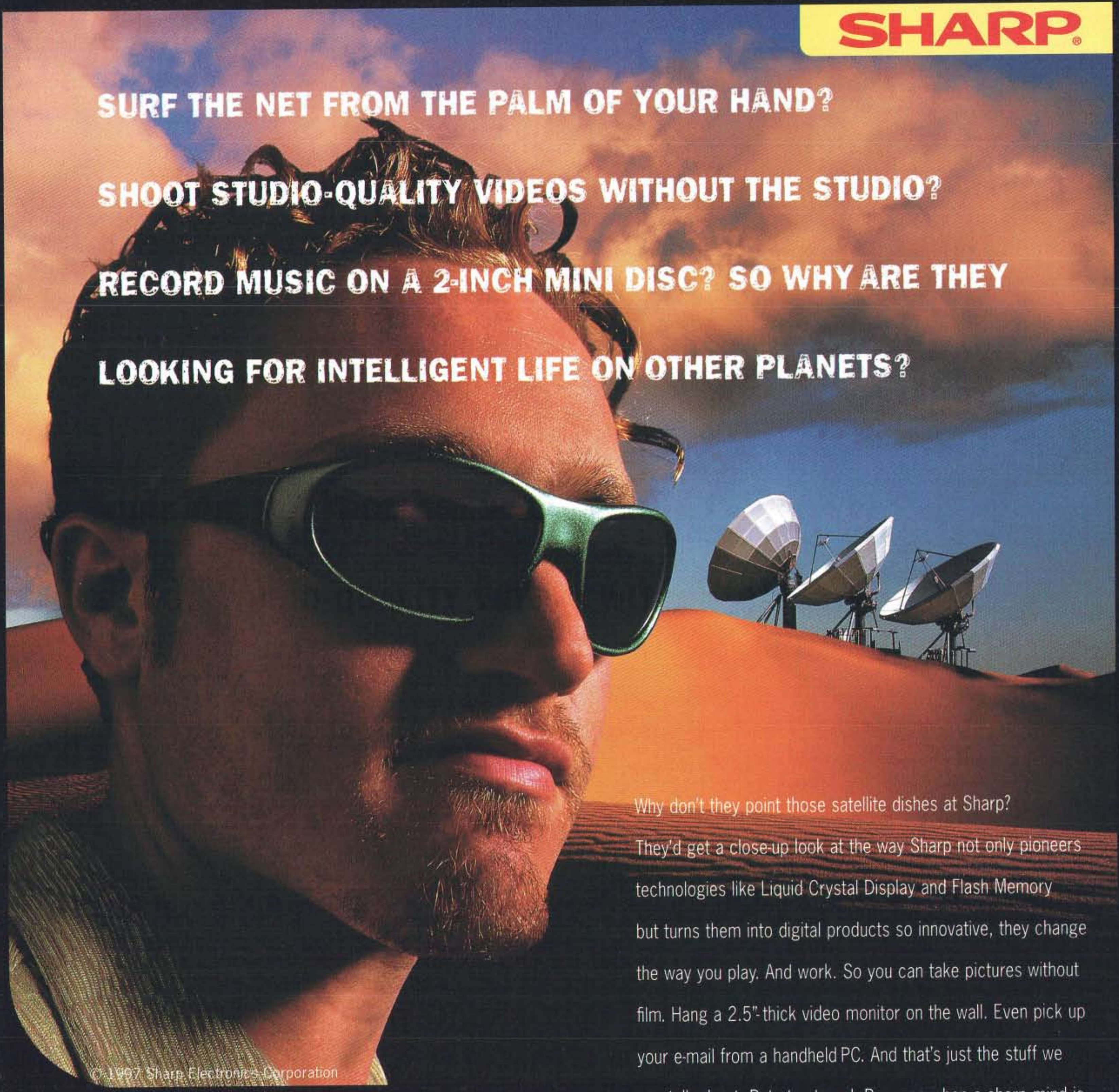
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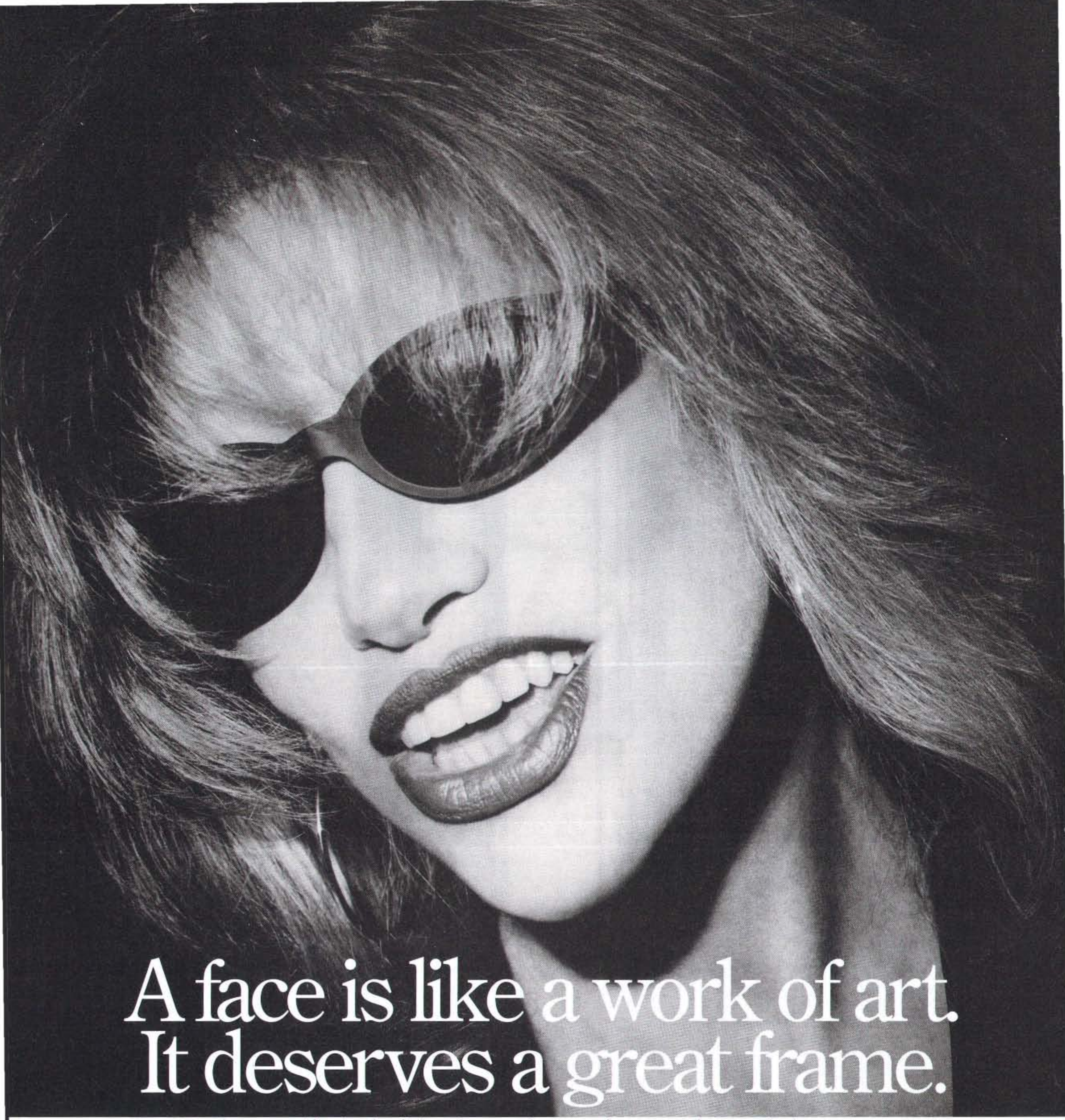
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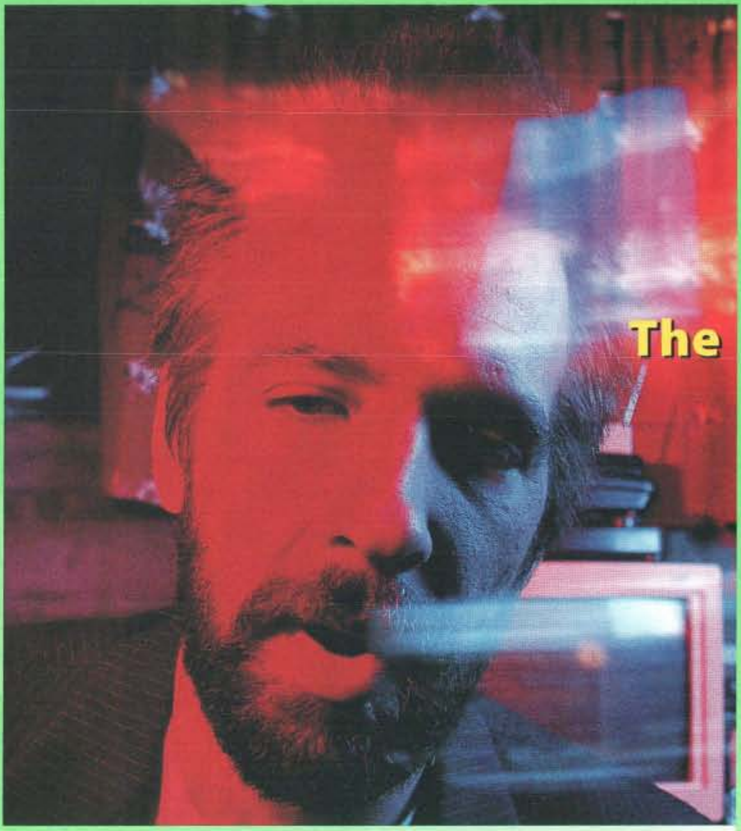


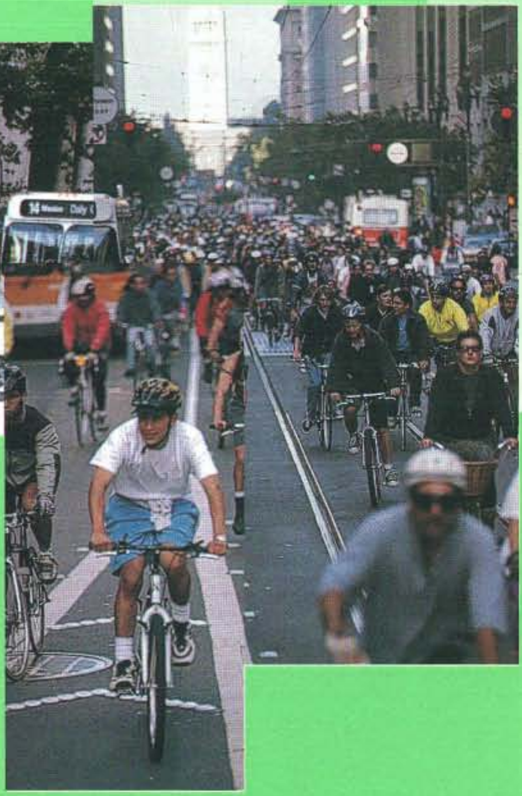
The Domain Wars

Like many people, Eugene Kashpureff thinks there's something wrong with the way domain names are handed out – and with who's in charge of them. But unlike most people, Kashpureff decided to do something about it: he rerouted traffic from Network Solutions' and InterNIC's sites to his own AlterNIC server on two separate occasions this summer.

Although Kashpureff settled out of court and circulated an apology on the Net, his actions mark the beginning of a struggle for control of the lucrative domain-name business as Network Solutions' exclusive contract with the National Science Foundation ends in March '98.

Some fear that the Net will become balkanized, as more Kashpureffs try for a piece of the action. From renegade individuals to multinational corporations and international governments, everyone is vying for their share. A proposal put forth by the European-based International Ad Hoc Committee to add seven top-level domains to ease congestion on the popular .com has been widely criticized as confusing. But the real concern is that the average user could get left out.

Is the lawlessness of cyberspace over? Not when it comes to domain names. "This issue is about power," says Harold Feld of the advocacy group Domain Names Rights Coalition, "and the devil is in the details." – *Rebecca Vesely*



Critical E-Mass

San Francisco's Critical Mass is part transpo-anarchy and part urban activism, with a healthy dose of infotech. A monthly event and political movement intended to highlight transportation issues, Critical Mass remained relatively low-profile until this summer when tension between the city and some 10,000 cyclists boiled over. As usual, bikers poured onto the streets during evening rush hour. But this time, the ensuing traffic snarls resulted in more than 100 arrests of allegedly brawling cyclists.

In five years, Critical Mass has swelled from dozens to thousands of riders – with no leaders – thanks in part to the Internet. "Anyone can make a suggestion online, and suddenly that's the plan," says Joe Speaks, a volunteer for the San Francisco Bike Coalition, which hosts a biking list. "It's the closest thing to working anarchy I've seen." – *Ashley Craddock*

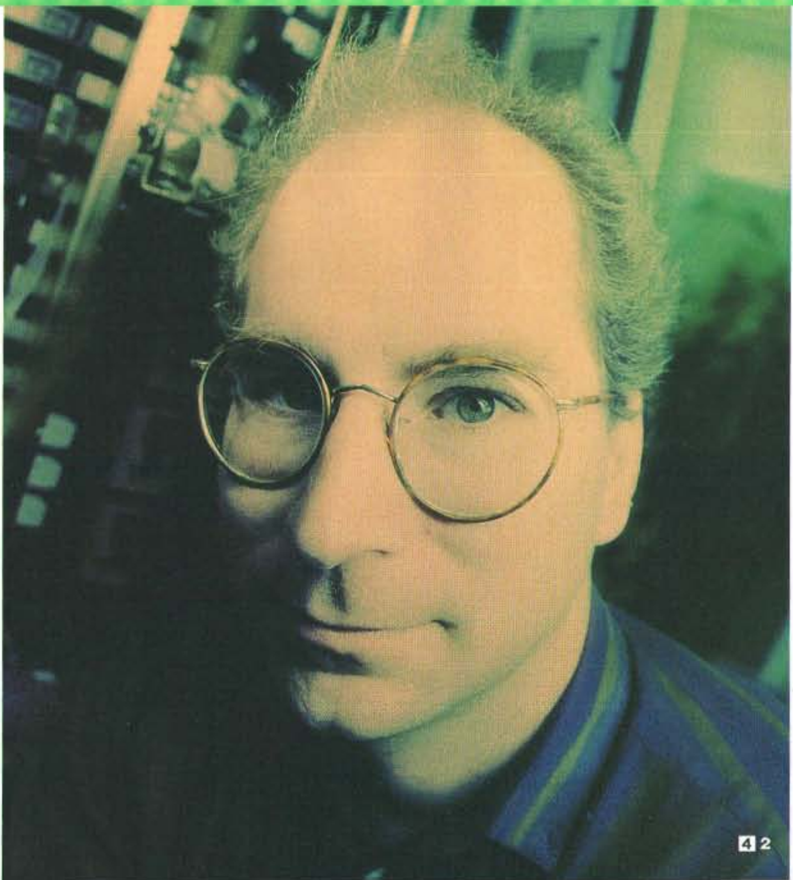
PHOTO ABOVE: REX RYSTEDT; PHOTOS BELOW: THOR SWIFT

Ratings = Censorship

Visit the Web site of the American Knights of the Ku Klux Klan *(www.imperium.net/~eastmje/)*, and you'll find a listing for "Klan News." There, in a white-hooded nutshell, is proof that a proposed Net rating system - one that would exempt news sites with an N rating from filters and browser blockers - is riddled with holes. Nevertheless, high-powered journalists from the likes of *The Wall Street Journal* and MSNBC are marching straight toward this particular pitfall in the belief that if the online industry self-regulates with a news/not-news system, Congress will find some other tree to pee on.

"Let's not get into the business of censoring ourselves," pleads Walter Isaacson, managing editor of *Time* and opponent of the N ratings. "How are we as a group supposed to decide whether *Playboy* or a Scientology newsletter is news or not? We shouldn't regulate free speech." Instead, he argues, let individuals decide which news sources are to be trusted. Radical idea, that. - *David Lazarus*

≡III Dunce Caps: We keep hearing (because they keep telling us) that the folks running America Online are customer-savvy marketing geniuses, especially former Procter & Gamble pitchster Steve Case and MTV founder Bob Pittman. So why is AOL mired in a public relations pattern suggesting a permanent case of Tylenol-tragedy syndrome? Just when they had eliminated the busy signals and healed the self-inflicted wounds of their flat-rate pricing debacle, Steve and Bob aimed at their own extremities again, by surreptitiously removing a phone number privacy promise this summer from the AOL Terms of Service. When will the geniuses start heading off problems, instead of mopping up after them? ≡III Pork Barrel 1, Science 0: Our latest Beltway lunacy comes courtesy of Senator Ted Stevens (R-Alaska), who apparently lost his compass. When the US National Science Foundation recently ►



Net Surfing's Last Gasp

Net surfing is an anachronism - a throwback to the days when every Web site carved its identity via a list of links. Today, most links are ads, paid for by other Web sites that need traffic to sell traffic. That surreal mathematics creates a huge opportunity: a chance to reintroduce purposeful connectedness. Thus, Alexa *(www.alexa.com/)* - a new navigation service conceived by Brewster Kahle, inventor of Wais and cofounder of Thinking Machines.

Alexa is an application that works in cooperation with your browser. It analyzes every site you visit - who owns it, how many sites link to it, and how popular it is. More important, it suggests where to go next based on which sites are similar and which sites other Alexa users have linked to. Along, of course, with others who've paid Alexa to be mentioned.

Some might be impressed by Alexa's instant-messaging add-on or its archive service, which strives to eliminate 404s forever. But these are the leather interior and rear spoiler - tangential to the quality of the ride. The real question: Does anybody still want to surf? - *Joey Anuff*

PHOTO ABOVE: MICHAEL LAVINE; PHOTO BELOW: WILLIAM FAULKNER

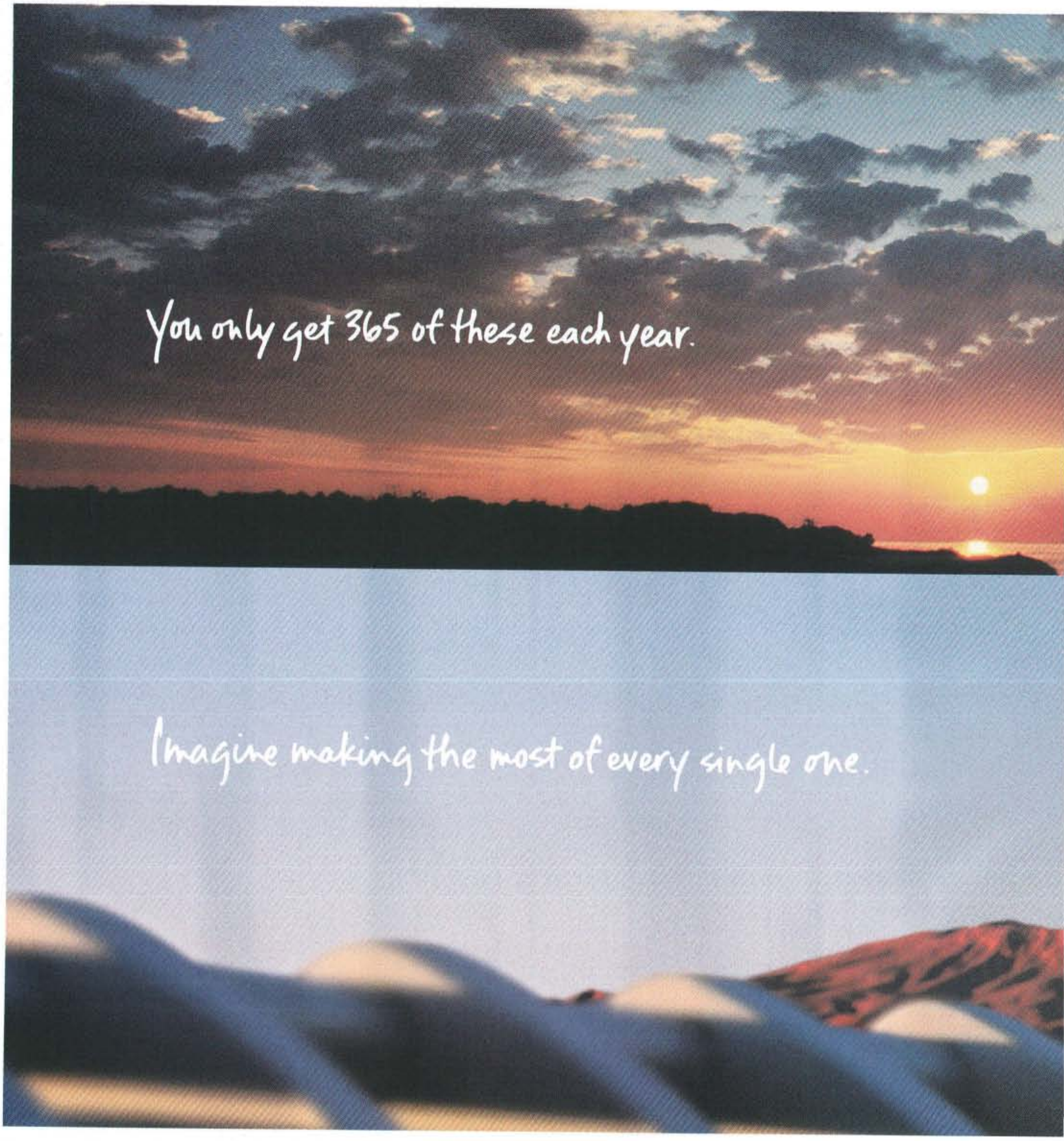
Mockumentarians

Can history be invented? If you're Jim and Vezna Tozzi, from Voyeur Films, it can. The husband-and-wife team is making a name for itself directing "mock-history" videos and commercials. Take, for example, the music video for "Seems," by Queen Sarah Saturday, which contains phony movie trailers, press conferences, and magazines.

Then there's the ersatz retro-commercials the pair recently made for Nick at Nite's TV Land, which trace the evolution of a fictitious, absurdly multipurpose product called Twip. "We wanted to fool people, so we put ourselves in the minds of '50s admen," says Jim Tozzi. "TV from back then – the acting, the pacing, the presentation – is alien to us. We used old lights and lenses to mimic the look at the time." They also added scratches and dust.

Look for the Tozzis' reality-bending work in Miller Lite beer commercials that appear to be created by a random dork named Dick. – *Mark Frauenfelder*

PHOTO: SKID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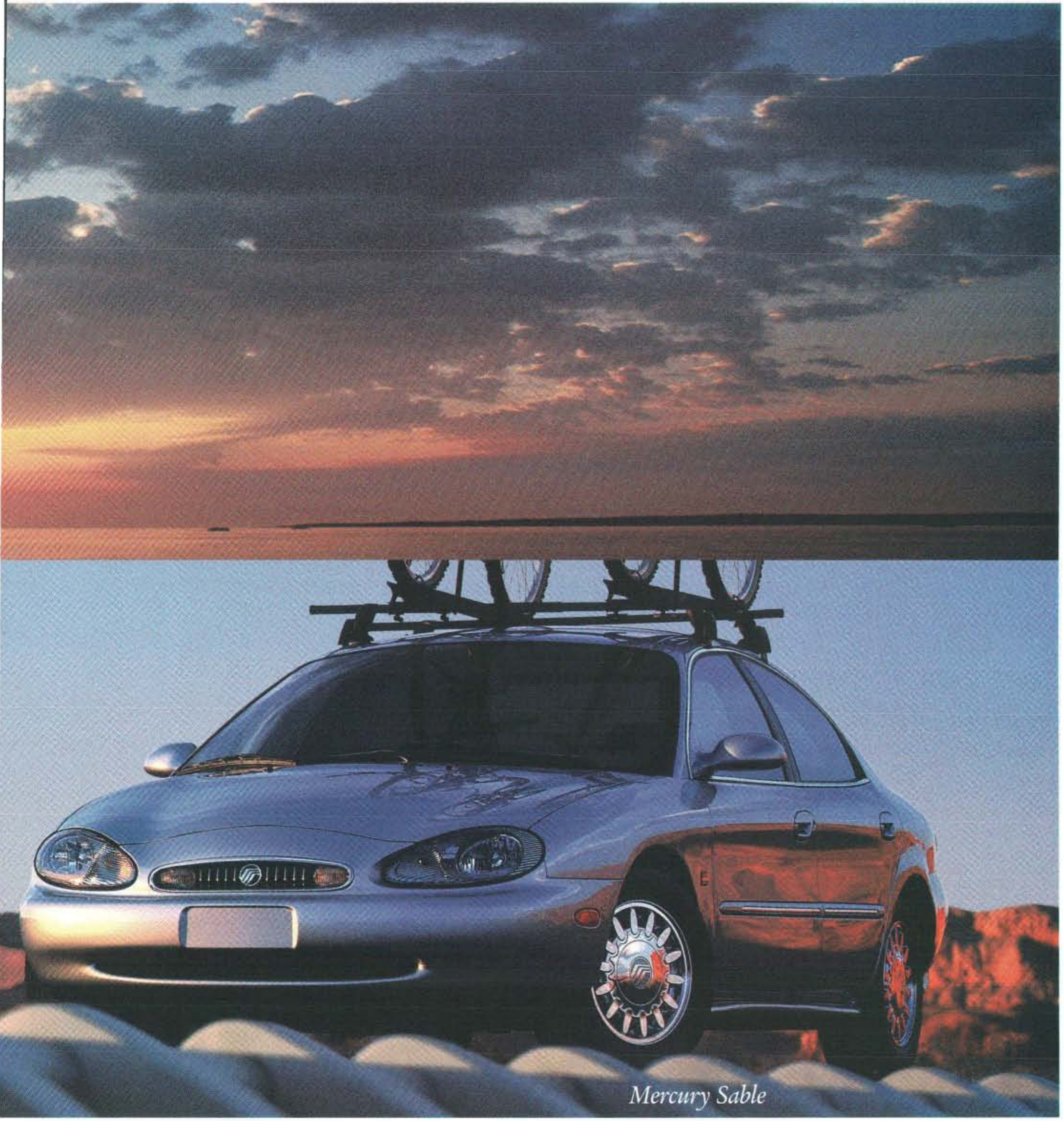

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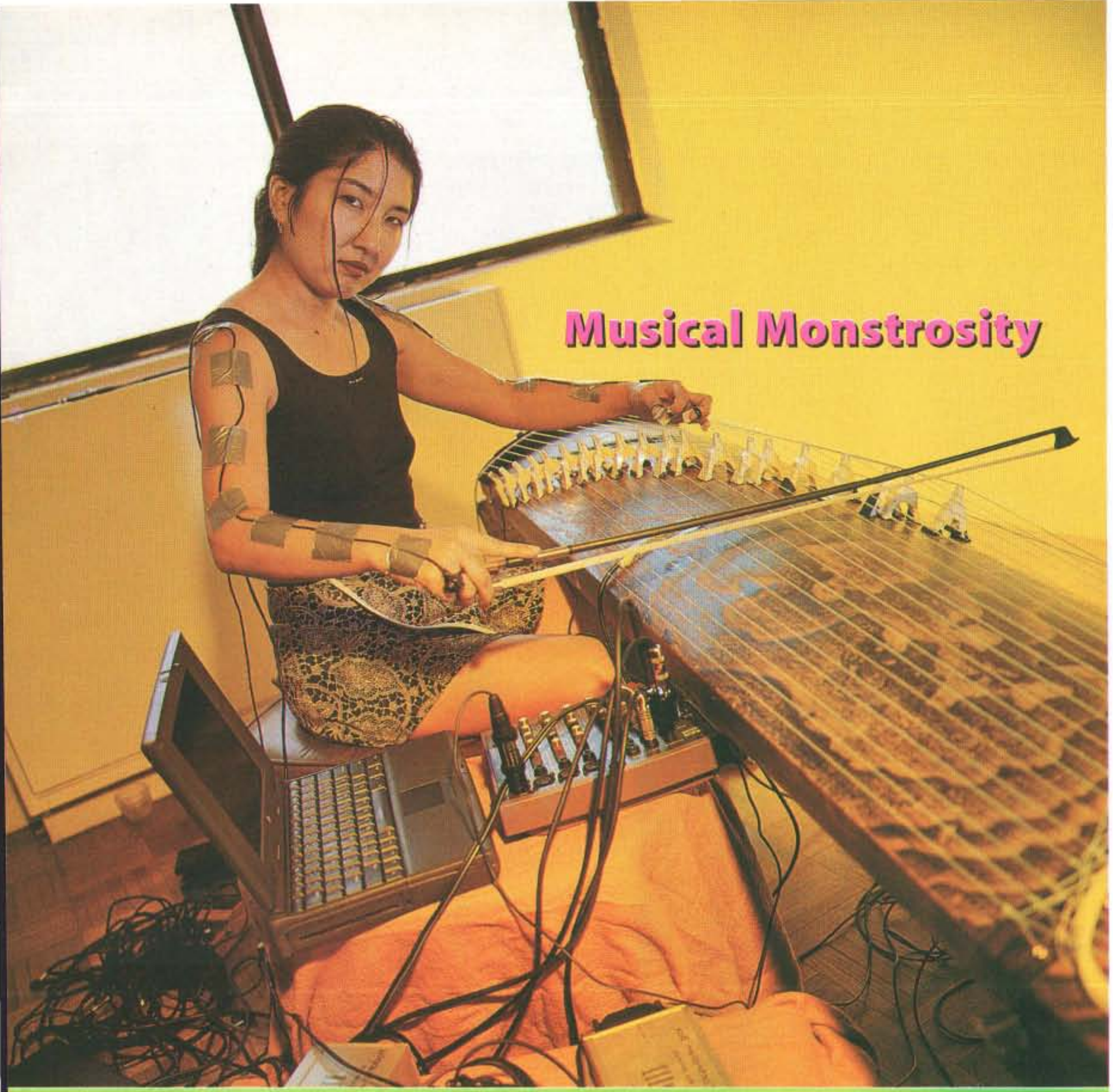


Musical Monstrosity

Miya Masaoka has created a music-making monster. The composer, based in San Francisco, describes the Koto-Monster as a musical Frankenstein - a 6-foot-long, 21-string, hollow-bodied harp-like instrument with myriad wires attached to Masaoka and to a microcomputer. "It even looks like a monster with solder, glue, cords, and cables," Masaoka says of the beast she cocreated with STEIM, a group of Dutch technicians. "It looks like technology out of control."

For this third-generation Japanese-American, the Koto-Monster's resounding volume and technological capacity add aggression - and shatter cultural misconceptions. "I bash a postcolonial myth of how so-called Oriental music should sound - a soft and flowing pentatonic scale evoking a stream - and how people playing it should look - different, mysterious, conniving, harmless, delicate, passive."

Jaron Lanier, a fellow composer, describes it more simply: rather than squeeze into old genres, Masaoka creates new ones. - *Evantheia Schibsted*

► budgeted US$25 million to build a radar to study ionospheric plasmas, it thought the natural place would be Resolute Bay, Canada, near the magnetic North Pole. But Stevens changed language in budget legislation to force the construction to his home state, hundreds of miles away. Does he expect the pole to follow? Pope (actually Antipope) Calixtus III once tried and failed to excommunicate a comet; we're guessing Stevens will have the same success shifting the earth's magnetic field. ≡III Media Multitaskers: The Net isn't killing television, but the broadcast bandwidth bandits should be running scared. Preliminary results from a Arbitron study of TV viewing by netizens show that the people who spend the most time online watch the most television, up to 20 hours per week. In fact, Yankelovich Partners claims that Net users are media junkies - they subscribe to more cable television, read ►

Ad-ding up the Net

The high tech industry brims with interactive ad agencies, but Agency.com is poised to become the cup itself. From a two-person start-up two years ago, Agency.com has become a multinational concern, opening an Asia office later this year and counting Lucent and MetLife as clients.

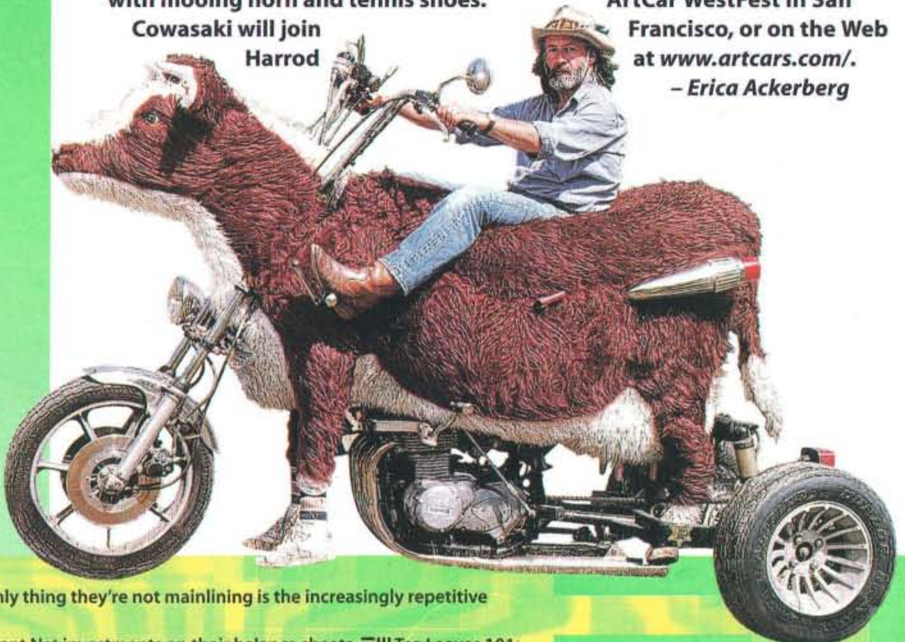
Most interactive firms struggle, but Agency.com's secret to success is simple: stand above the fray by buying it. This summer, the company acquired a major stake in Web shops Online Magic and Spiral Media. Former shrimp-boat captain turned CEO Chan Suh (near left) assures us this isn't a move toward empire. "I'm basing our growth on the Net model. Hosts connected by protocols." - *Austin Bunn*

PHOTO ABOVE: GIRL RAY

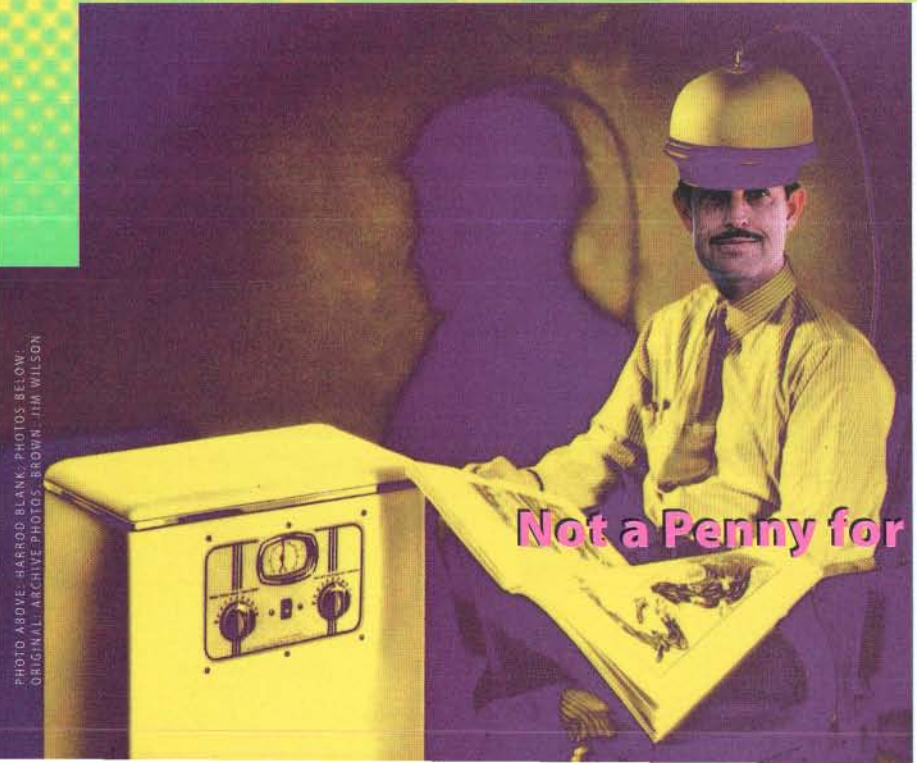
TIRED	WIRED
Vespas	GoKarts
Encapsulation	Transparency
Unidentified flying objects	Remote-piloted vehicles
Italian suits	Chinese pajamas
Timothy Leary	William S. Burroughs
Telecommuting	Commuting by jetpack
Eastern Europe	Deep Europe
ABC's content	ABC's ad campaign
Scientologists	Raelians
Paper shredders	Magnetic-media disintegrators

Holy Cow!

Meet the Leonardo da Vinci of the art car movement, Houstonian Larry Fuentes. Originally a three-wheeled Kawasaki motorcycle, the Cowasaki is one of a small fleet of vehicles crafted by Fuentes. The fully functioning cowmobile comes complete with mooing horn and tennis shoes. Cowasaki will join Harrod Bank's Camera Van, a 1972 Dodge covered with 1,700-plus cameras, and Ron Dolce's 18-year labor of love – a marble-and-glass-adorned Volkswagen bug – in a parade this fall. Wheel on out to the mobile Renaissance at the First Annual ArtCar WestFest in San Francisco, or on the Web at *www.artcars.com/*. – *Erica Ackerberg*



► more newspapers, and listen to more radio than their offline neighbors. The only thing they're not mainlining is the increasingly repetitive sitcom diet of broadcast TV. Now we know why NBC, CBS, and ABC have significant Net investments on their balance sheets. ≡III Tea Leaves 101: As if we needed further confirmation of Apple's downward spiral, trade magazine publishers recently went out of their way to supply them. In August, Softbank's Ziff-Davis and IDG, normally bitter rivals, decided it just wasn't worth fighting over the shrinking pie of Macintosh advertising dollars. So they called a truce and merged Ziff's *MacWeek* and IDG's *Macworld*, while killing off Ziff's anemic *MacUser*. At almost the same ►



Not a Penny for Your Thoughts

Evan Brown's former employer, DSC Communications of Texas, is suing him to find out what he thinks.

While driving home one day, Brown claims he figured out a method to reverse-engineer computer software into higher-level source code. His solution, he believed, could apply not only to DSC's own outdated code, but to virtually any code – allowing companies around the globe to modernize their software in a snap. DSC initially offered to partner his venture and share the profits, Brown says, but then withdrew the offer and demanded that he reveal his idea, citing a 10-year-old employment agreement. When Brown refused to tell, DSC fired him and promptly filed suit.

"Generally, if an employee signs a contract to give the employer ownership of all of the inventions he conceives while employed ... the employer owns the invention rights," says Herbert Wamsley, executive director of Intellectual Property Owners. But Brown, who worked in the switch products group of DSC, claims his idea was neither conceived on the clock, nor within the scope of DSC's telecommunications business or his job description. Both parties head to court in November. – *Joe Nickell*

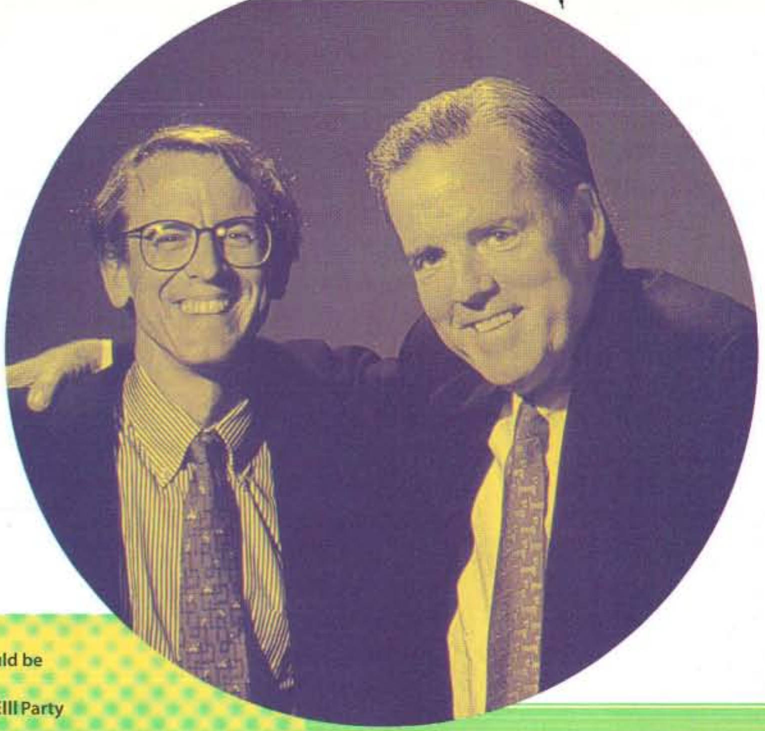
PHOTO ABOVE: HARROD BLANK; PHOTOS BELOW: ORIGINAL ARCHIVE PHOTOS; BROWN: JIM WILSON

Silicon Valley PAC, Sort Of

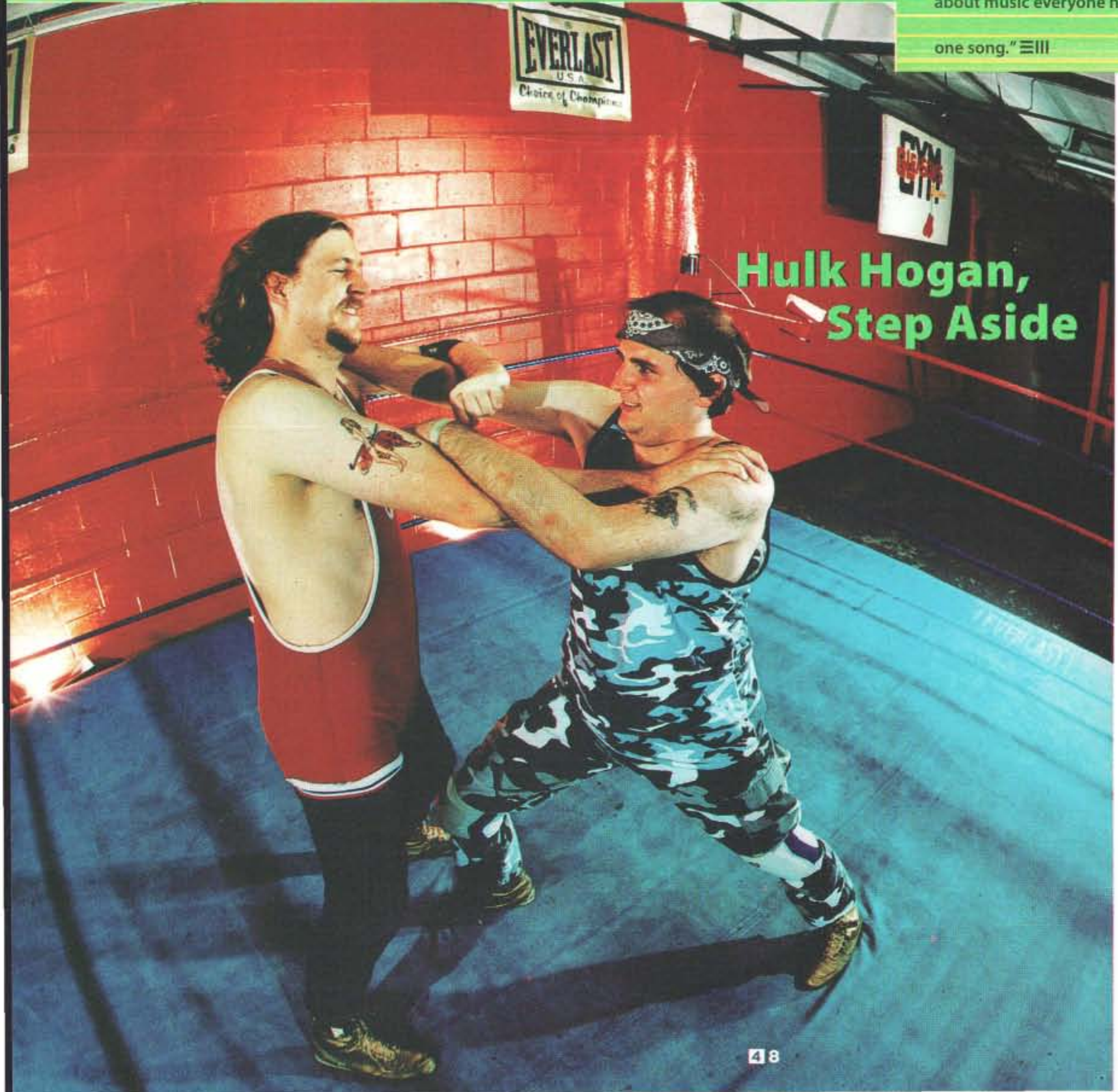
This summer, venture capitalist heavyweight John Doerr (near right) joined forces with Netscape CEO Jim Barksdale to create the Technology Network, a bipartisan coalition formed to advance the new economy and boost the high tech industry's political clout. With an ambitious agenda to promote securities litigation reform and improve the US educational system, Doerr describes the organization as a new kind of "political network."

Dig a little deeper, however, and TechNet's way-new methods look like old-fashioned politicking: the group will organize face-to-face meetings between high tech CEOs and government leaders and make PAC contributions to election candidates. Such tactics may seem new in Silicon Valley, but they are old school everywhere else.

But who cares? Doerr's chummy relationship with Al Gore is already yielding dividends. In July, President Clinton pledged to work with Senator Christopher Dodd (D-Connecticut) to craft legislation curbing securities litigation lawsuits. – *Todd Lappin*



► time, another trade publisher, CMP, announced that its 13-year-old *CommunicationsWeek* would be rechristened *InternetWeek*. More proof that you should go long with your Internet portfolio. ☰III Party Tapes = Opportunity: Those formula-addicted record industry executives are staring at flattening sales figures and desperately foisting their genre (electronica) and format (DVD) tricks on consumers to reverse the trend. But a market research report produced for the clearly self-interested Liquid Audio Web site *(www.liquidaudio.com/)* suggests it's finally time to do the obvious: let consumers download individual songs, and in the process provide a multibillion-dollar boost to music sales. How? By exploiting the market niche inherent in the one phrase about music everyone has repeated: "I would buy that CD, but I only like one song." ☰III



Hulk Hogan, Step Aside

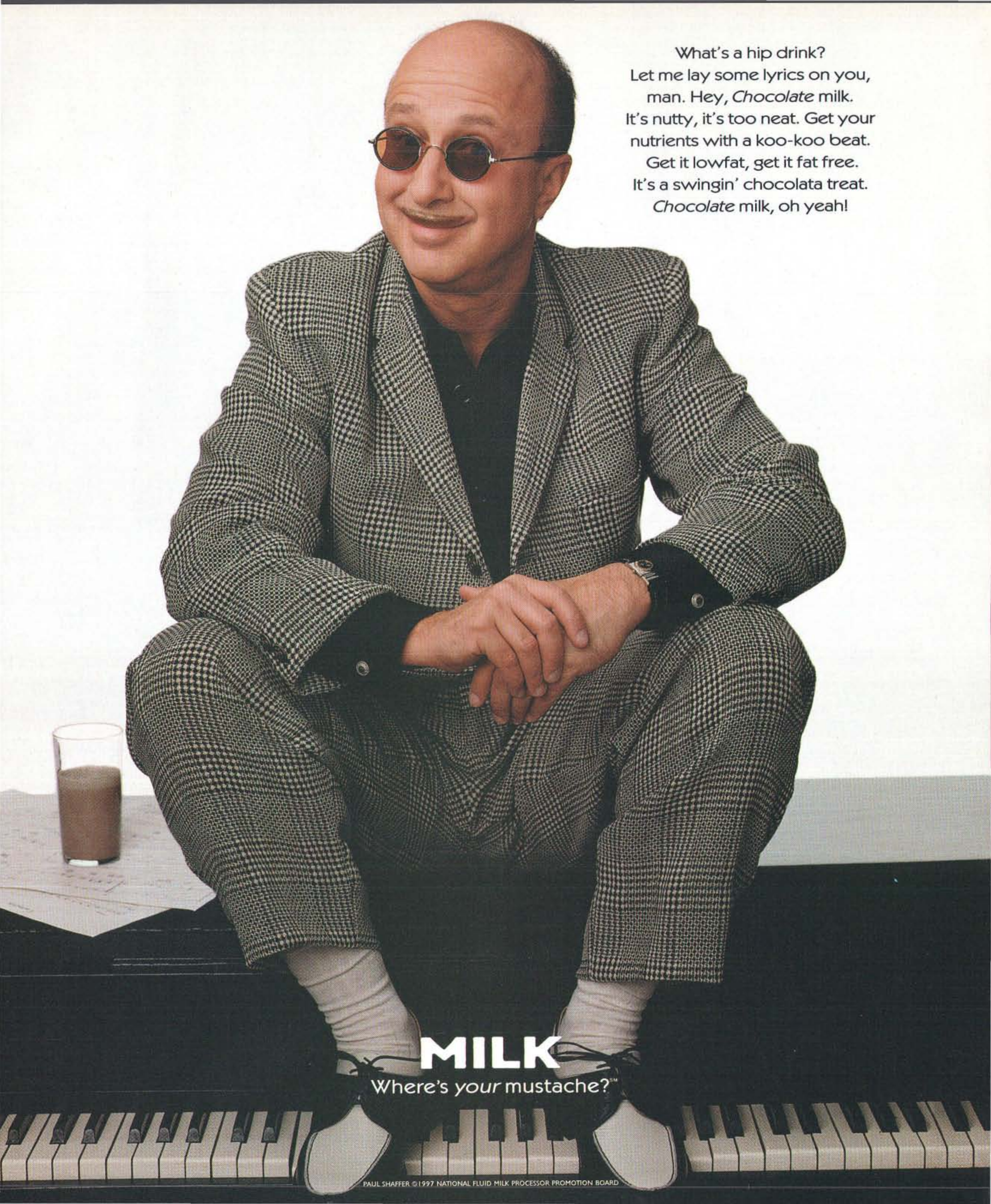
Neither Jeff Berry nor Ray Duffy looks like he'd be trouble in a fight. But Berry (far left), a sysadmin for NASA, and Duffy, an email administrator for Smith Barney, have reinvented themselves as two of the baddest SOBs in cyberspace – the kings of e-wrestling.

Loosely organized in federations, thousands of e-wrestlers square off in virtual matches conducted via email. It's a simulation of a staged sport – a postmodern pastime for geeks with an aggressive streak and a taste for the absurd.

Berry and Duffy have been combatants since 1992, when they began a year-long feud. Their rivalry earned them a place in the e-wrestling Hall of Fame *(www.contrib.andrew.cmu.edu/~ja3k/e-wrestling/HOF/index.html)*.

Why wrestling? "There's a story that isn't there in other sports," says Berry. "It's a performance, so there's room for writing and role playing." Or, as real-world wrestling's Classy Freddie Blassie might say: On the Net, no one knows you're a pencil-necked geek. – *Mark McClusky*

PHOTO BELOW: RAPHAEL FUCHS



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nutrients with a koo-koo beat.
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It's a swingin' chocolata treat.
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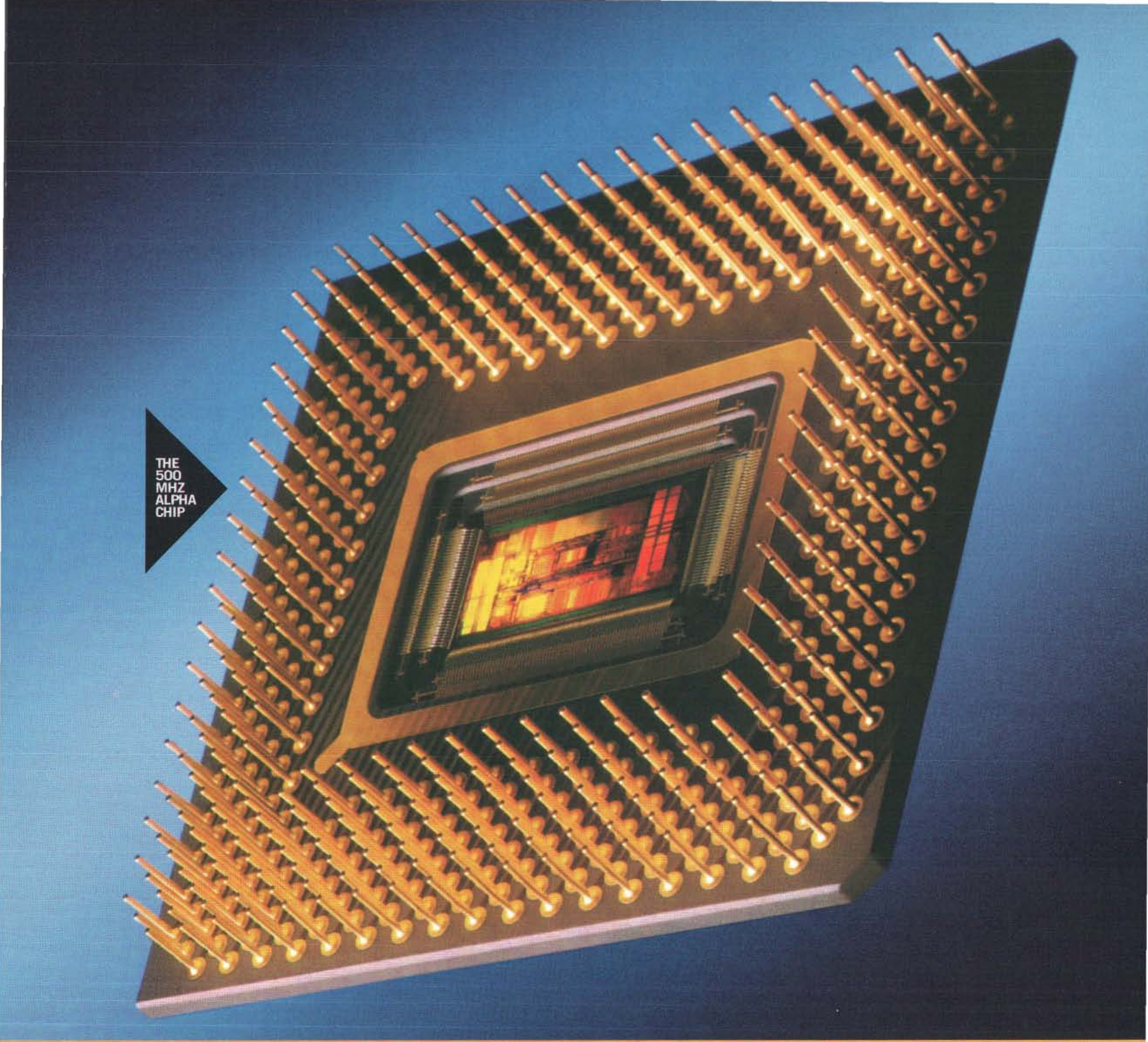

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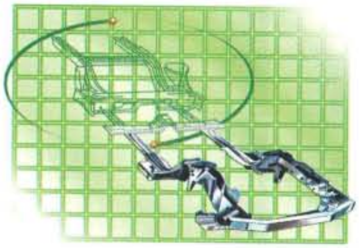

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The Generation Gap

The Old Guard wants to ban strong cryptography to protect the national security state. **The Young Turks** want to unleash strong crypto to protect the national economy – and our privacy.

A report from the front lines of a struggle for the future.

By Rebecca Vesely

It's a sweltering July afternoon in Washington, DC, as a dozen lawmen dressed in dark blue suits file into a meeting room on Capitol Hill. The broad-shouldered cops stroll confidently through a crowd of lobbyists, journalists, and congressional staffers, push aside the "reserved" cards placed before their front-row seats, and settle into their chairs. The men are supercops - bigwigs from the FBI, the National Security Agency, the Drug Enforcement Agency, and the Commerce Department - and they've come to Congress to declare war on strong encryption.

On this particular day, the lawmen are on hand at a meeting of the House International Relations Committee, which is poised to vote on the Security and Freedom through Encryption Act, better known as SAFE. Sponsored by Representative Bob Goodlatte (R-Virginia), SAFE would prohibit the government from imposing any controls on the use of strong encryption within the US and relax the export regulations that bar American firms from selling such software internationally. The bill is a darling among high tech companies and civil libertarians, but to the law enforcement guys, SAFE is a nightmare.

As the Feds settle into their seats, lobbyists from Netscape, Microsoft, and Pretty Good Privacy huddle along the side wall, biting their nails and seething about the supercops in hushed, nervous tones. Although SAFE has attracted strong support in the House, the massive show of institutional force by the national security apparatus is a grim indication that the tides have turned in the encryption debate. Only a few months ago, high tech lobbyists were prodding the White House to relax its encryption export controls. Now, they're fighting to keep the technology legal.

Surprisingly, however, the ominous, front-row presence of the supercops was not enough to sway the International Relations Committee. Nor was the flurry of anti-SAFE letters sent by Defense Secretary William Cohen and Attorney General Janet Reno. At the end of the day, the committee passed SAFE by a voice vote.

Yet much greater challenges lie ahead. The ongoing battles over encryption policy have exposed a glaring rift between two vastly different political camps inside the Beltway - each fighting to uphold a different vision of the future. For the aging Cold Warriors who fantasize that crypto can be closely controlled, the future looks ►

Rebecca Vesely (rebecca@wired.com) *is Washington bureau chief for Wired News.*

like a reprint of an old James Bond movie, replete with heroic cloak-and-dagger struggles against drug lords, terrorists, and rogue foreign governments. But for those with a deeper understanding of digital technology, the future brings the growing invisibility of national borders, a distributed realignment of political and economic power, and an increasing vulnerability to forms of espionage that have little to do with national governments and everything to do with the global economy. Meanwhile, civil libertarians say that recent efforts by the Cold Warriors to mandate the use of encryption key recovery systems within the United States pose a monumental threat to a basic civil liberty: privacy.

The crypto debate is no longer about export controls. We're now talking about policies that will have a clear impact *within* the United States.

"This debate is no longer about export controls," says Alan Davidson of the Center for Democracy and Technology. "It's becoming clearer and clearer that we're talking about what's going to happen domestically with encryption."

Such suspicions were confirmed by FBI assistant director Jim Kallstrom, the agency's foremost wiretapping authority, when he told the House International Relations Committee: "We don't give a damn about export. We care about protecting people domestically." Trouble is, Kallstrom and his allies want to "protect" Americans with an unwieldy, insecure, and potentially unconstitutional encryption key recovery scheme that would require citizens to make their private communications accessible to law enforcement in advance of *any* evidence that they have participated in a crime.

Big Brother reanimated

Admittedly, the strong-arm lobbying tactics used by the Clinton administration's national security all-stars have not yet proven effective in the House, where SAFE now enjoys a full majority. But over in the Senate, the story is entirely different.

The reigning chair of the encryption debate is Senator John McCain, the powerful Arizona Republican who heads the Senate Committee on Commerce, Science, and Transportation. McCain is widely known as a free-market iconoclast – a reputation he solidified in February 1996, by becoming the lone GOP senator to vote against the Telecommunications Act that ostensibly deregulated the telecom industry. McCain opposed the act because, he said, it didn't do enough to create competition and keep the government's hands off the market. But as a former US Navy pilot who spent more than five years in a North Vietnam POW camp, McCain takes a hard line on national security issues, and the crypto debate has forced him to make an awkward choice between his free-market idealism and his hawkish national security instincts. Ultimately, his Cold War anxieties prevailed.

McCain signaled his new resolve last spring, when he joined forces with Senator Bob Kerrey (D-Nebraska), the ranking member of the Senate Foreign Relations Committee, to introduce S 909, the Secure Public Networks Act – a crypto bill so restrictive that it could cost the US software industry billions of dollars in lost sales while also creating a national system for online wiretapping that would breathe new life into the tired Big Brother cliché. The McCain-Kerrey bill reinforces existing encryption controls that limit the strength of exported software to only 56 bits for companies that promise to install key recovery features within two years. (For those that refuse to make such a promise, the export limit will remain at a feeble 40 bits.) The bill also creates a domestic key recovery scheme that would effectively require anyone who wants to buy or sell products on the Internet to give up a copy of their encryption keys to a "key recovery agent" approved by the US government. (Imagine being required to hand over a copy of your front door keys to a government-certified locksmith.) Any law enforcement agency would then be able to obtain quick and easy access to encrypted data by getting copies of private keys from key recovery agents with only a subpoena – a legal hurdle that is much less stringent than a search warrant because it does not require police to rigorously demonstrate "probable cause" that an individual has been involved in a crime.

To accomplish the monumental task of providing police with this access, key recovery centers would be set up across the country and – the Clinton administration hopes – around the world. These centers would handle and store keys to encrypted data for the sole purpose of allowing law enforcement agencies quick access to any suspicious information traveling over networks. But with billions of transactions and communications stored on individual hard drives and zipping through cyberspace, the system envisioned in the bill – and endorsed by the White House – would rival the US post office in scale. However, unlike the post office, privacy would in no way be assured. In a day-to-day sense, the McCain-Kerrey bill is tantamount to ordering the US Postal Service to ban envelopes and requiring everyone to send all their mail on postcards. Meanwhile, the post office would also make a copy of each card and keep it in a central database that would, by its very nature, be vulnerable to mismanagement by postal officials with all the intelligence and integrity of Cliff Clavin from *Cheers*.

"We don't believe it will work," Michael MacKay, vice president of Novell, flatly told the Senate Judiciary Committee this summer. Peter Neumann, principal scientist at SRI International, calls the idea of government-mandated domestic key recovery "ludicrous." ►

ILLUSTRATION BY SCOTT MENCHIN

Even Dorothy Denning, a professor of computer science at Georgetown University and a vocal proponent of key recovery, says in a recent study on encryption and organized crime published by the National Strategy Information Center, "Mandatory key recovery would force users to take risks they might consider unacceptable, particularly with respect to their communications where they might not need key recovery for their own purposes."

Denning's study also throws into doubt the FBI's assertions that it needs access to crypto keys to solve crimes. Worldwide, she reports, the total number of criminal cases in which encryption has been used hovers at about 500. But in many of those cases, crypto did not prevent or even slow crime-solving efforts by law enforcement. Although Denning and study coauthor William Baugh, a former assistant FBI director, warn that the use of encryption by organized criminals and terrorists is on the rise, they also doubt that domestic key recovery and export controls will do much to stop this trend.

The steady drumbeat of fear sounded by the FBI and NSA has inspired members of Congress to propose unworkable solutions to a dubious crisis.

Nevertheless, the drumbeat of fear sounded by the FBI and NSA has inspired several members of Congress to propose unworkable solutions to a dubious crisis. Senator McCain's recent conversion to the side of the crypto hardliners has been particularly damaging, and it has left many observers wondering what prompted his sudden about-face.

The answer, it turns out, is blandly familiar. Last spring, national security officials visited McCain to give him the latest version of their crypto gloom-and-doom scenario. The Briefing, as it is called, has become a rite of passage in Congress, as almost every member has been subjected to it in one form or another. Some report that the meeting begins with a dramatic Cold War song and dance, during which agents sweep the meeting room for bugs. They then talk about the use of encryption technology by the Cali drug cartel. They discuss PGP's worldwide availability and its use by terrorists, pedophiles, and illegal gamblers – and so on and so on, with the purpose of instilling a neurotic fear that the American way of life will go to hell in a handbasket unless police are somehow given access to the keys that protect encrypted data.

Of course, law enforcement has a legitimate interest in trying to prevent crime. But other factors may be at work as well. FBI director Louis Freeh, for example, has a few skeletons in his closet: no explanation for the crash of TWA Flight 800, no resolution in the Saudi bombing, no more suspects in the Atlanta Olympic Park bombing, reports of mishandled evidence at the FBI crime lab – the list goes on. Implicitly, at least, strong encryption provides Freeh with a plausible explanation for some of the FBI's recent failures while also raising the specter of a new and unseen criminal menace. As Republican Senator Jon Kyl of Arizona fretted, "I don't want to be sitting here a few years from now having law enforcement tell us we had the opportunity to stop terrorism and did not."

Such arguments struck a chord with McCain. "This is not something I say often, but the three senators cosponsoring this bill: myself, Kerrey, and Massachusetts Senator John Kerry, all have one thing in common: we all served in Vietnam," the spry Arizonan told me while I visited him on Capitol Hill. "The strongest opponents to this bill have never heard a shot fired."

That is the fault line that divides the old guard from the new. Four long years after the White House's former crypto flack, Mike Nelson, first called encryption "the Bosnia of telecommunications policy," the analogy still holds true. For the grizzled Cold Warriors, encryption is a fixed opponent to be surrounded, rolled back, and conquered. But for the high tech industry, private sector businesses, and millions of individual Internet users, strong encryption provides a powerful defense against the anarchic jungle combat of economic espionage and computer fraud. In the digital age, crime has less to do with criminals using the system than with criminals *breaking* into the system. Yet the law enforcement community and its sympathizers envision their criminal foes as looming Death Stars – large, easily identifiable targets equipped with ample resources and big guns – not as small, distributed guerrilla fighters armed with nothing more than a decent PC and modem, some patience, and lots of guile.

Political calculus

In fairness, worries about crime must be taken seriously by any elected official. In a society infected by an undercurrent of nervous fear, taking a tough stance on crime wins more votes than serving as a poster child for civil liberties. It would be career suicide for any politician to appear as if his or her views on crypto liberalization facilitated an incident like the 1994 World Trade Center bombing. (Ramsi Yousef, who was convicted for the bombing, had encrypted information on his computer that outlined plans to blow up 11 US-owned commercial airliners, although that information was also found in decrypted form.)

As Peter Harter, global public policy counsel for Netscape, puts it, looking strong on encryption "allows the Cold Warriors to get on their horses and trot off into the sunset in the name of law and order and the American way."

Inside the Clinton administration, the rift that divides those who want fewer controls on crypto and those

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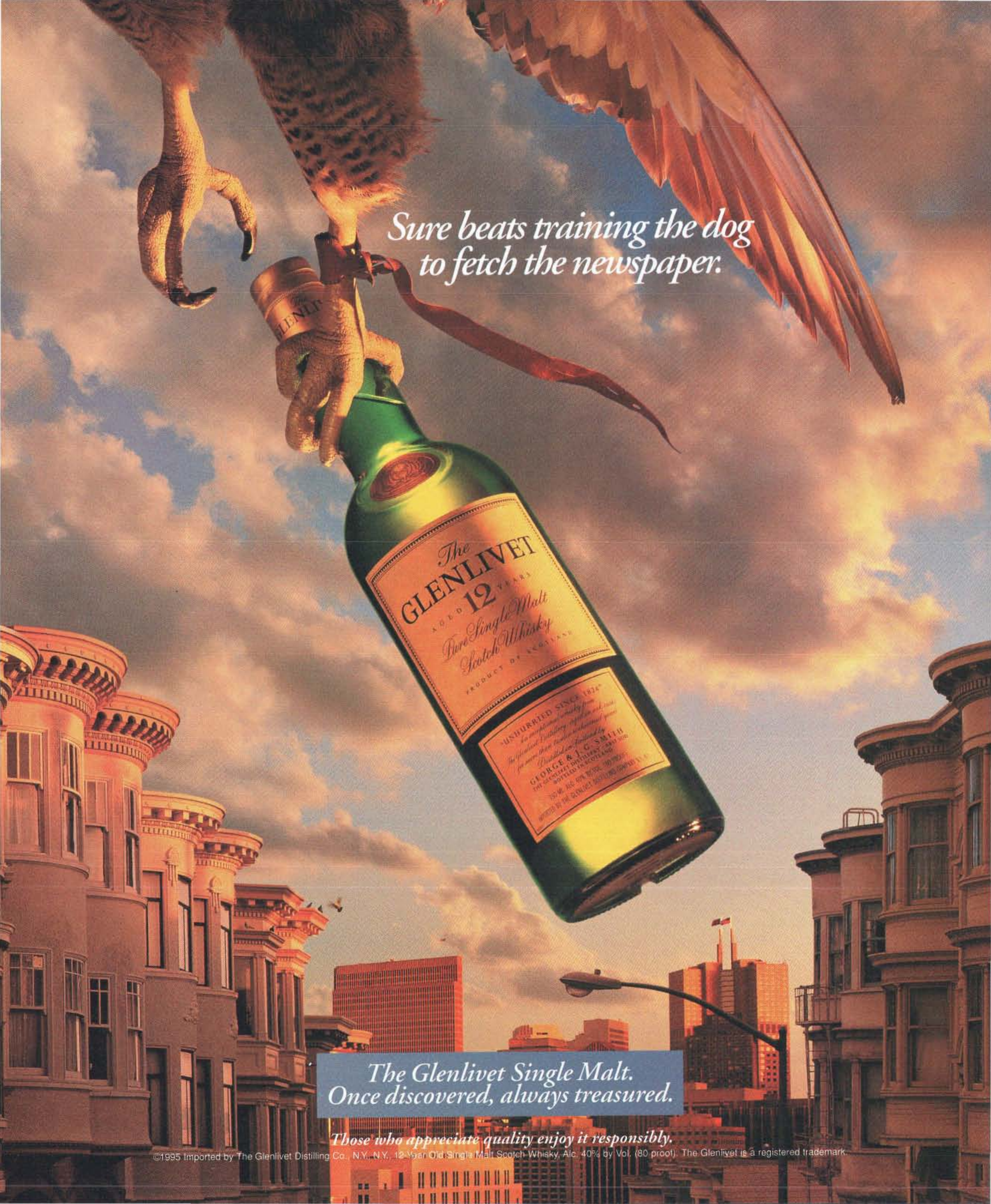
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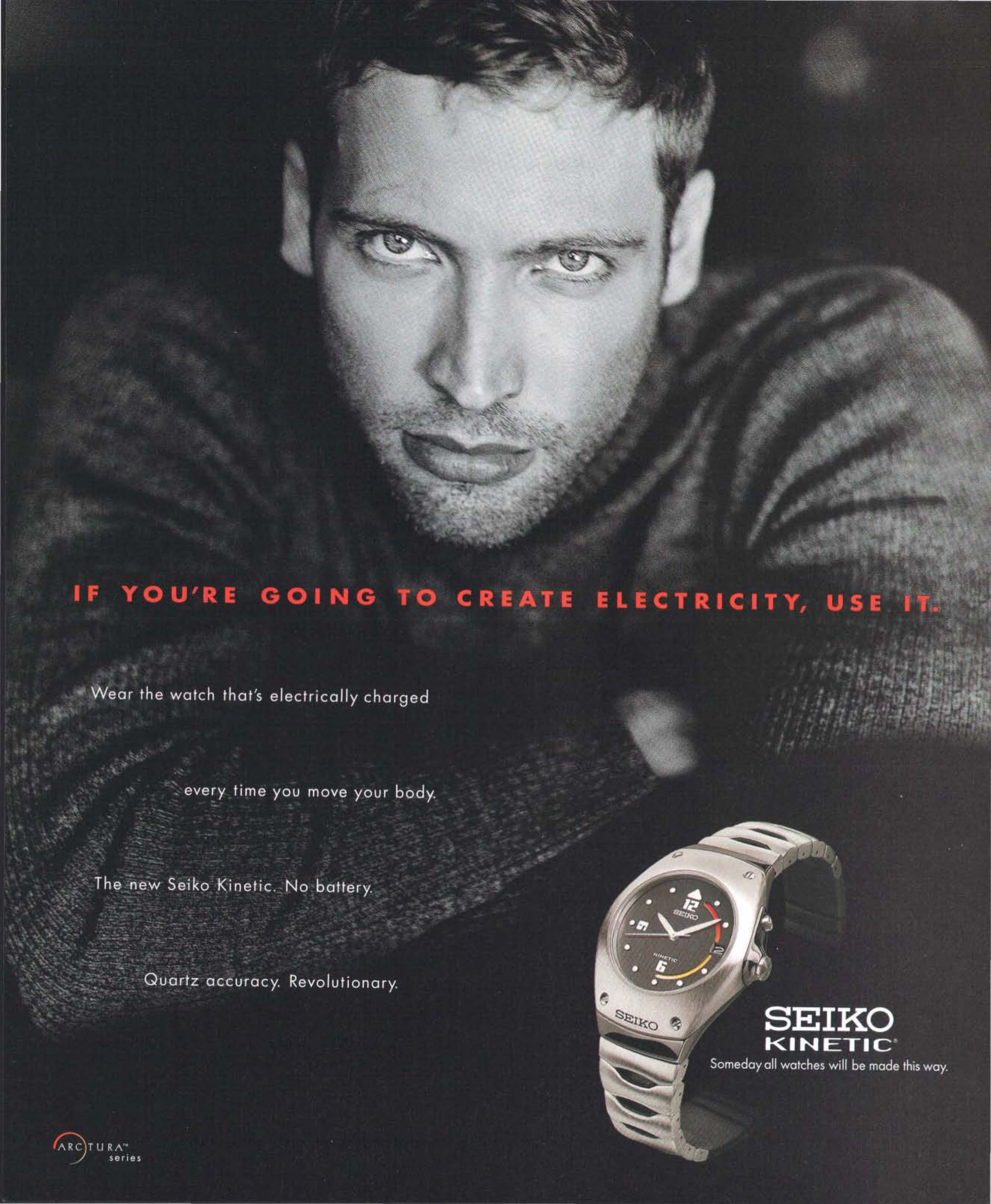

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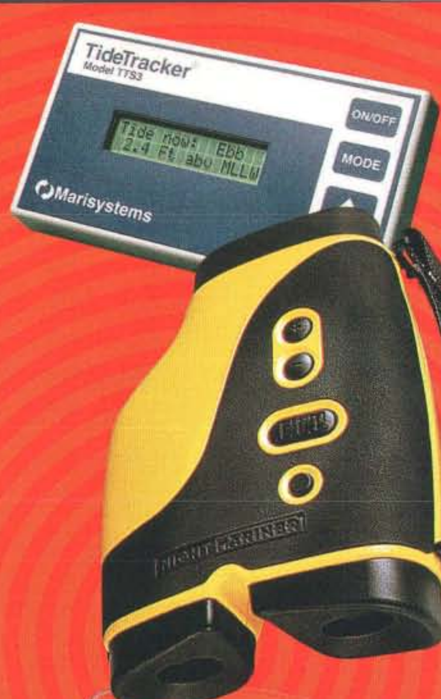

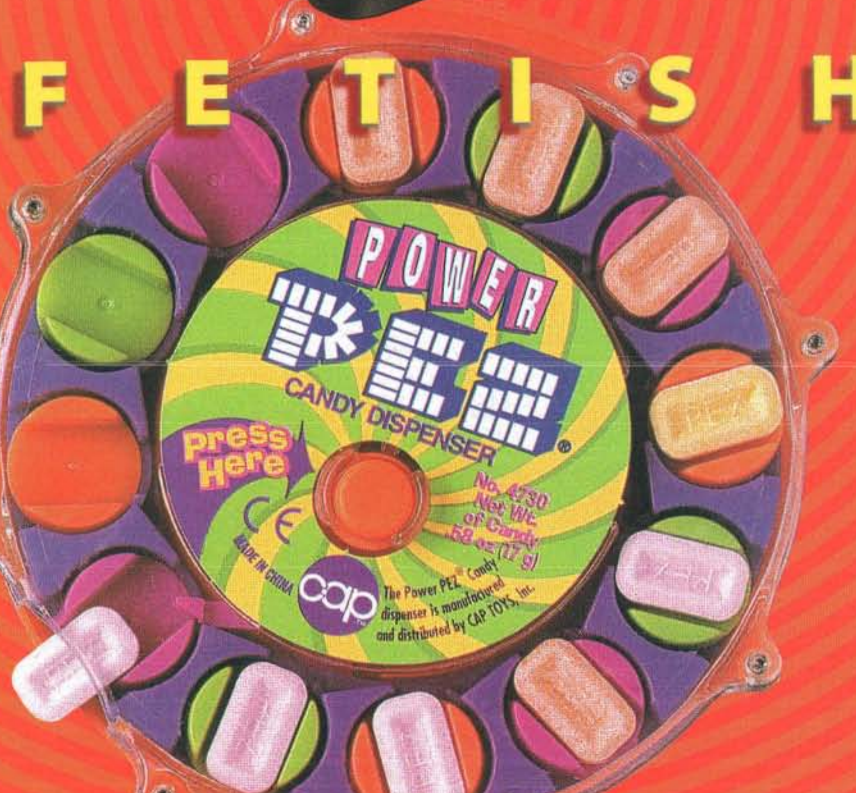
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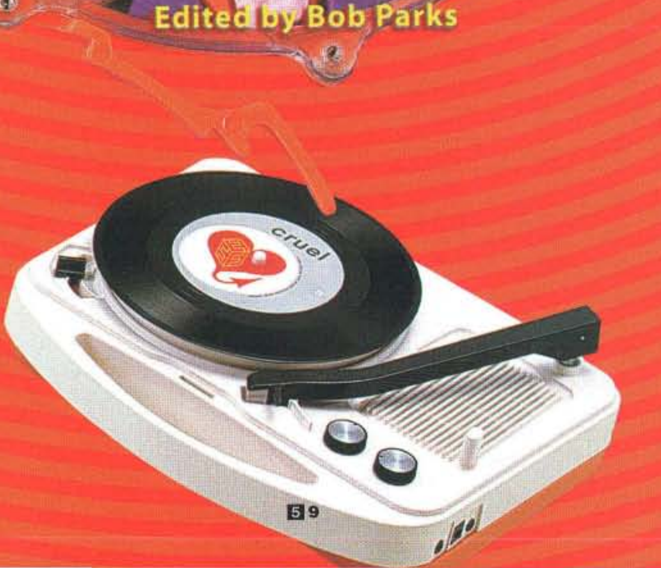

Epic

Even a stoned Jeff Spicoli couldn't miss a wave with this superlative surfing tool. The TideTracker instantly provides the time of the next high or low tide, the hours until the next peak current, and the current's direction and velocity. Just choose between the US East Coast or West Coast versions and key in your location. Based on data programmed into the device about the position of the sun and moon, the TideTracker will let you know how long to wait until the next good break. TideTracker: US$129. Marisystems: (800) 528 4337, + 1 (617) 341 3611, on the Web at www.marisystems.com/.

Wax

The built-in speaker on the VP96, with its scratchy mono sound, will remind you of the pleasures of playing records as a kid. Open this lightweight turntable, slap on some vinyl, pick a speed (it has both 33 and 45 rpm), and place the needle. You can't get that kind of noise on CD. The record player plugs into the wall or runs on 1.5-volt battery power, and it looks like a lunch box when you carry it. Now all you need is that KC and the Sunshine Band LP. VP96: ¥12,800 (US$100). Vacuum Records: + 81 (6) 543 1755, on the Web at www.osk.threewebnet.or.jp/~vacuum05/.

Evolution

Someday we'll all have a permanent coating of gallium arsenide over our eyes, but until then you'll have to pick up a pair of Night Vision scopes to see in the dark. Older generations – the ones in '80s commando movies – used infrared to boost available light. But Night Mariner 260 uses a micro-channel plate to increase sensitivity and eliminate distortion. And you need not fear dropping these pricey binocs in the lake while seeking the nightingale and its song; the waterproof housing also floats. Night Mariner 260: US$2,495. ITT Night Vision: (800) 448 8678, on the Web at www.ittnv.com/.

Rapid

Just as the single-shooter pistol evolved into the Samuel Colt revolver during the middle of the 19th century, so has the classic Pez dispenser grown into Cap Toy's 12-round motorized candy implement. Purists might miss the quaint oversize heads of Bullwinkle or Dumbo atop the old standard issue, but you'd be hard pressed to beat the Power Pez Candy Dispenser's firing rate of more than 40 ppm (yep – Pez per minute). And just like the guns of the Old West, it fits on your belt for a quick draw. Power Pez Candy Dispenser: US$6. FAO Schwartz: (800) 876 7867, on the Web at www.faoschwartz.com/.

Broadcast

If the ViaTV Phone takes off, it could inspire a new industry of stunt doubles to stand in for average-looking smooth talkers on that telltale first date. Invented by a small Silicon Valley company, the ViaTV Phone is a cheap alternative to teleconferencing units, and it's simple to set up – just plug it into your TV's antenna and a regular phone line. You can even zoom in on the other caller. Oh, sudden movements or busy clothing patterns may degrade the picture quality, so try to keep your cool when you talk up that new sweetie. ViaTV Phone: US$549. 8x8: +1 (408) 727 1885, on the Web at www.8x8.com/.

Coach

Some people sleep better on planes, perhaps from the sound of the rushing air, the climate control, or the strong cocktails. You can't stay at 32,000 feet all the time, but a few of Greg Benke's airport lights around the yard will help you feel ready for takeoff, even when you're in your own bed. The designer orders heavy-duty aluminum stands from the same company that supplies JFK and LAX, then he rigs up the lamps to take ordinary household voltage. For your own airfield, pick up a couple of taxiway lights (blue) or runway lights (white). Airport runway lights: US$375. Limn: + 1 (415) 543 5466.

Zen

The average remote has scores of buttons and dials. But Sutherland Engineering's new silvery smooth power stick has none at all – it turns listening to music into a ritual with the elegance of a Japanese tea ceremony. Rotate the C-2000 to the right to turn up the volume, to the left to make it softer. The remote also lets you change audio sources between CD, tuner, and phono. For now, it comes only with Sutherland's high-end preamplifier and CD player, which also make sophisticated additions to the pared-down lifestyle. C-2000: US$8,850. Sutherland Engineering: +1 (785) 841 3355.

Strong

In a perfect world we'd all use floss, but sometimes it's just too much of a bother. That is, unless you cruise down to your local drugstore and get a roll of Ranir's Hi-Tech Dental Floss, a milestone in getting the grit out from between your teeth. Better than ordinary teflon or nylon, this new dentifrice is made with a type of polyethylene – a tenacious fiber used for boat sails and bulletproof vests. The floss slides easily between those pearly whites, then spreads out into small scrubby strands to root out plaque. And it tastes minty-fresh. Hi-Tech Dental Floss: US$4. Ranir: on the Web at home.sprynet.com/interserv/fluor/.

LAMP, FLOSS PHOTOS: J. BUTLER

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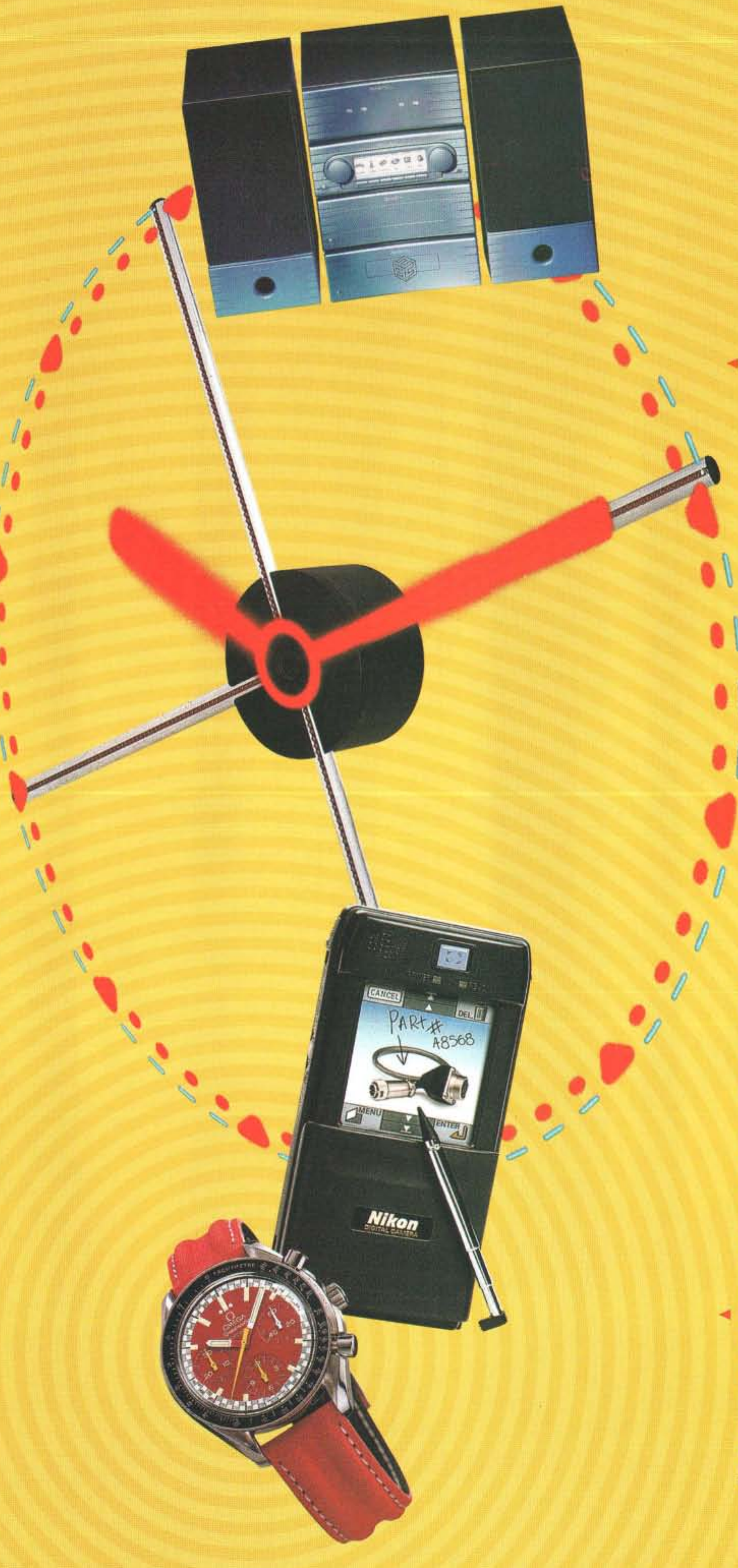

Graphic

Carrying the faceplate from your car stereo for security reasons can become a habit, like setting the brake. So why not indulge that same instinct at home? Conceived by frogdesign, Dual's bluish-silver stereo uses a GUI control panel that snaps off and works as a remote. Its grayscale LCD screen changes depending on whether you've selected the tuner, cassette, or CD, and organizes the functions no less than two clicks deep. Smarter than the average audio component, Dual also remembers your favorite tracks on 100 CDs. MN 8010 G: DM1,999 (US$1,113). Dual: fax + 49 (201) 727 5865, on the Web at www.my-world.de/.

Easel

Even da Vinci might have had trouble successfully pitching a new product by sketching it on an old-fashioned greaseboard. But with the Coolpix 300, the most fumble-fingered artist is sure to be a hit. Nikon's new camera lets you take digital photos then add recorded audio clips and handwritten notes through a 2.5-inch touchscreen. When you're done, use a SCSI cable to connect Coolpix to your Mac or PC – or plug it right into a TV and hold a videoconference. Your work may not sway the critics, but you'll certainly sell the boss. Coolpix 300: US$690. Nikon: (800) 526 4566, on the Web at www.nikonusa.com/.

Ghost

This techno trompe l'oeil shows you the face of a clock glowing on the wall, but the image is really the work of blinking LEDs on a spinning axis. Because the human eye can't keep up with the lights revolving at 250 rpm, persistence of vision takes over. Without it, this new creation would just be a fancy light-brite fan. While the clock would be good for the lobby of a museum, in an office everyone will waste time trying to figure out how the damn thing works. Virtual Image Clock: US$2,995. Electrokinetics: +1 (212) 473 1125.

Bright

As the only timepiece that passed all of NASA's rigorous stress tests and appeared on the wrists of astronauts on the moon, the Speedmaster is steeped in history. So why bother getting race-car driver Michael Schumacher to endorse the latest model? (Someone in the marketing department obviously forgot this watch's already storied past.) Despite its new detailing and fruity colors, though, this is still the same trusty Speedmaster and should make you feel as indestructible as it is. Speedmaster Racing Watch: US$1,450. Omega: (800) 766 6342, on the Web at www.omega.ch/.

Thanks to Marla Aufmuth, Rakesh Patel, and Jennifer Sullivan.

You'll feel it. Your computer won't.

Force feedback adds the sense of touch to supported games so you can actually feel the game. But a force feedback joystick isn't worth a dusty Pong if the stick is pulling processing power from your computer and slowing down your game. That's why the Microsoft® SideWinder® Force Feedback Pro has a 25MHz 16-bit "force co-processor" that does all the force computation on the stick. Which means your computer feels nothing, and your games are never slowed down. Force Feedback Pro is as much as six times faster than other force sticks. So you'll see and feel every Uzi recoil, every stall on take-off from O'Hare, and every nine-iron you shank to the left.

There's also real rocket-science stuff inside the Force Feedback Pro. Like Microsoft-patented digital-optical technology. Imagine a tiny infrared camera that detects handle and throttle motion to within one-hundredth of a degree without any wear or calibration.

The stick is also easily customizable, so in just a few seconds you can program each button the way you like to play. And forget port hogging. Force Feedback Pro has only one computer cable and plugs into your gameport. Plus, you can test all these features right away with the three killer games included in the box: Interstate '76,™ Star Wars® Shadows of the Empire:™ Battle of Hoth,™ and MDK: Mission Laguna Beach.™ The Microsoft SideWinder Force Feedback Pro. It's designed so that everything in your game will be felt. But only by you. For more information (yes, believe it or not, there is more), go to www.microsoft.com/sidewinder

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Before you buy a digital camera, know all the facts.

	640 X 480 Resolution	Removable Memory	Built-In LCD	Progressive Scan CCD	Optical Viewfinder	High Resolution Lens	Video Output	Macro	Built-In Flash	Pocket Size	Total
Potential Points	15	15	15	10	10	10	10	5	5	5	100
Yashica KC 600	●	●	●	●	●	●	●	●	●	●	**100**
Nikon Cool Pix 300	●		●	●	●		●	●	●	●	75
Fuji DS-7	●	●	●	●			●	●		●	75
Olympus D-200 L	●		●	●	●	●		●	●		70
Panasonic CoolShot KXL-600A	●	●		●	●		●	●		●	70
Sony DSC-F1	●		●	●			●	●	●	●	65
Casio QV-120	●		●	●			●	●		●	60
Ricoh RDC-2E	768x576	●	optional		●		●	●	●		60
Epson PC 500	●	●	optional	●	●				●		55
Kodak DC 25		●	●		●				●	●	50

640 X 480 Resolution What you need to send clear, high quality pictures by e-mail, to create your own web pages, insert your original photos into presentation documents and create custom calendars and greeting cards.

Removable Memory Allows you to take as many pictures as you like and quickly transfer your images into your Mac or PC computer. With the included CompactFlash memory card, the KC 600 lets you view your pictures instantly. When your CompactFlash card is full, simply insert another and keep shooting!

Built-In LCD Allows instant viewing of pictures. If you don't like a specific shot, you can erase it and shoot over.

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Optical Viewfinder Choose between the optical viewfinder or the built-in LCD for composing pictures. By using the optical viewfinder you can greatly increase battery life.

High Resolution Lens With more than 100 lines of resolution, the KC 600 lens assures sharper images, improved color, contrast and brightness.

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Among these necessary features found on the Yashica KC 600, a host of others are also included. Features such as Macro for close up shots, built-in flash, red-eye reduction, a convenient pocket-sized body for travel and MGI PhotoSuite SE software (the easiest way to edit, organize and be creative with your photos on a PC).

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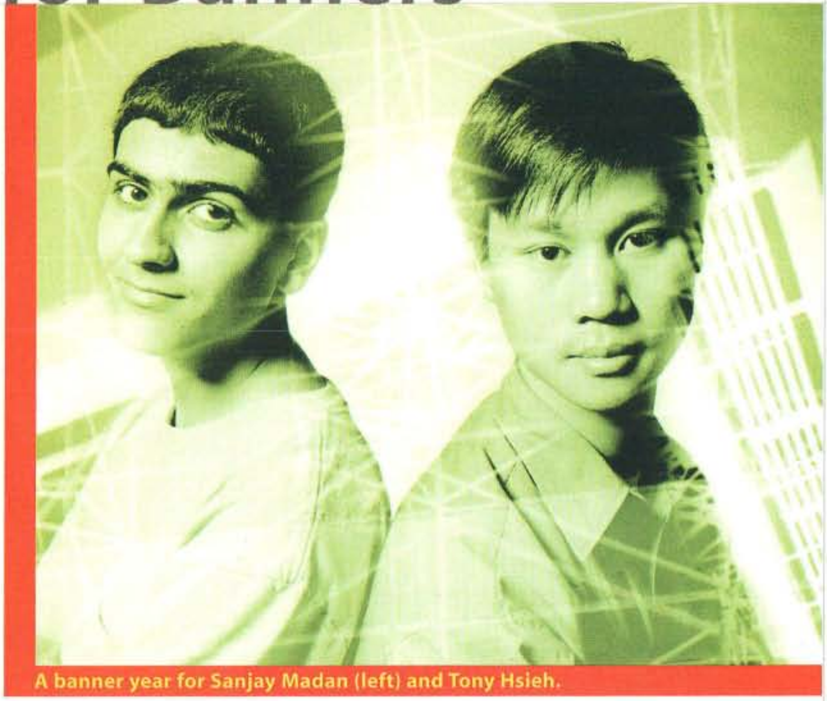
Barter for Banners



A banner year for Sanjay Madan (left) and Tony Hsieh.

It has all the makings of a good old-fashioned Web success story – youth, idealism, a good idea, 24-hour workdays, and, somewhere down the road, the possibility of making lots and lots of money.

Our heroes this time are Sanjay Madan and Tony Hsieh, two computer science grads from Harvard who started a side business developing Web sites while working their first postcollegiate jobs at Oracle. In an effort to help their small-business clients generate traffic, the entrepreneurial pair hit upon the simple but effective idea of a banner-exchange program. That way, they figured, participating sites could get more exposure without having to pay for it.

The idea caught on immediately – within a couple of days, dozens of sites had joined the network. Within a week, Madan and Hsieh decided to put everything else aside to concentrate solely on their new project.

A little more than a year later, their company, LinkExchange, has become the Web's largest ad network, with about 100,000 member sites and 800 new sites added each day.

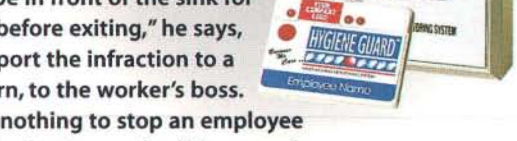
LinkExchange is an advertising banner-swap network with 100,000 member sites.

According to a March audit conducted by Web statistics firm I/PRO, those 100,000 sites deliver about 4 million ad views per day. The daily impressions are sliced up three ways: half are devoted to promoting member sites, a quarter go toward promoting LinkExchange itself, and the remaining quarter are earmarked for sale to paying customers.

With 25 workers jammed into a San Francisco warehouse, LinkExchange's headquarters has the ragtag look of either a low-budget volunteer operation or The Next Big Thing. In a way, the company is both. "From the start, our goal has been to make our members happy," Hsieh says. "Our company has grown by providing the services our members have asked for."

Venture capitalists are beginning to knock on LinkExchange's door, but its founders insist they're more concerned with customer service than selling out. "We want to bring banner advertising to everyone on the Web, not just the big corporations," says Madan. "Everything we do is guided by that goal." – *G. Beato*

Big Brother Is Washing You



No matter how often you remind them, some food-service employees still forget to wash their hands after using the rest room. But bathroom-borne germs will soon be decimated if Net/Tech International can help it. The company is testing Hygiene Guard, an infrared system that monitors employees in the rest room.

"A small dome on the ceiling floods the bathroom with infrared rays," explains Net/Tech spokesperson Mark Hersh. "When an employee enters the bathroom, it activates his or her badge. The employee has to grab the soap dispenser handle and be in front of the sink for at least 15 seconds before exiting," he says, or the badge will report the infraction to a computer and, in turn, to the worker's boss.

Of course, there's nothing to stop an employee from removing the badge to sneak off for a smoke, but if records show they never visit the rest room, management may begin to suspect that something foul is going on. – ***Dave Cravotta***

PHOTO ABOVE: KEVIN IRBY

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Barbara Traub

Get Paid to Get Spam

As Congress clamors for a crackdown on unsolicited commercial email, the four young entrepreneurs who founded Intellipost are gambling that lucrative incentive programs can short-circuit antispam hostility. Under Intellipost's BonusMail program, consumers who fill out an online questionnaire agree to receive a steady stream of email ads. In exchange, subscribers are rewarded with BonusMail points that can be redeemed for frequent-flier miles, long distance calling time, and gift certificates to companies such as the Gap and Tower Records.

Intellipost started sending its "directronic" ads to 50,000 members on June 30. Cofounder Steve Markowitz says the company hopes to sign up several hundred thousand members in the first year – which adds up to a whole lot of spam in a whole lot of in boxes. – *Andrew Gilbert*

Steve Markowitz has a special offer for you ...

Fear of a Schwa Planet

What's more believable: a recent US Air Force report that explains 50 years of extraterrestrial sightings in New Mexico as high-altitude crash test dummies, or Schwa, an alien-run corporation that has controlled Earth since the late 1940s? Based on sales of Schwa paraphernalia, it seems that more people are buying the Schwa story.

The Schwa alien's guitar-pick-shaped face (an ovoid, in Schwa parlance), first spotted in UFO zines, then later appearing on skateboards, automobile bumpers, and computer monitors, has become one of the most infectious memes in the global metropolis. It has been spotted on MTV and the BBC, sold in Jerusalem, and licensed in Japan, yet many native earthlings continue to wonder what the hell it is.

What is known is this: Schwa began on Bill Barker's drawing table in the summer of 1992. Barker, 40, a conceptual artist and former advertising art director, had been looking for a way to satirize the marketing industry when a pal gave him a copy of *The Secret Government* – a book that details how an alien conspiracy dominates Earth. Barker had an epiphany and began sketching. Then, a few days later, the ovoid insignia was staring back at him. And within a year, the logo had become the basis of a mail-order company peddling Schwa paraphernalia – a business that has supported Barker ever since.

The power of Schwa is derived from the desires and anxieties we bring to it.

The recently published *Schwa World Operations Manual* transforms the Schwa mystery into a profound critique. The book ("banned on over 13,000,000 planets!") offers step-by-step instructions on how to take over and govern your own world. In the process, it also parodies a menu of "official" documents: permits, surveys, warranties, contracts, and flow charts. Through our allegiance to such standardized forms and marketing campaigns, Barker suggests, we surrender ourselves to a dehumanizing force – a force that is alien only on the face of it. – *Brad Wieners*

Jargon Watch

Bubba-lock Gridlock traffic jams created whenever President Clinton's motorcade comes to town.

Cradle Cams The increasingly popular Web cams installed in day-care centers and grade schools that allow parents to monitor their children from worksite desktops. Also known as Kiddie Cams.

Script Kiddies Wannabe hackers who use ready-made exploit scripts written by more experienced hackers to break into online sites.

Security Dots The asterisks or bullets that appear onscreen as you enter a password.

Stay-or-Bail Moment The precious few seconds that elapse after loading the front page of a Web site, during which one decides to either stay or leave. Used by David Siegel in his book *Creating Killer Web Sites*.

Tip o' the Greek fisherman's cap to Anne-Marie Concepcion and Sameer Parekh.

– *Gareth Branwyn* (jargon@wired.com)

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Real Tests for Real Kids

The quest to measure the skills that count.

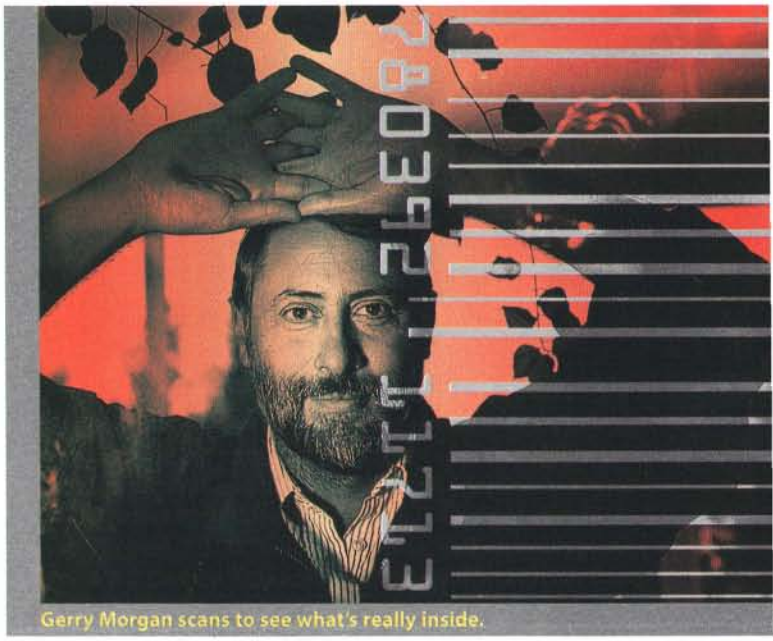
For anyone who has ever worn down a No. 2 pencil while wondering how any standardized test can possibly measure true intelligence, Canadian educational software developer Gerry Morgan may have found a way to assess what really counts.

As an idealistic science teacher in Calgary, Alberta, during the late 1970s, Morgan decided teachers spend too much time preaching behind podiums instead of teaching kids how to think for themselves. "In today's economy, we don't depend on other people to give us a job," he says. "We depend on our own resourcefulness." Standardized tests such as the notorious SAT and ACT, he concluded, were the culprits.

By training kids to do well on SATs, experts say we de-emphasize the skills they need.

To teach students more about creativity, insight, teamwork, and flexibility, Morgan loaded an old school bus with Macintosh computers and drove his Merry Prankster classroom to schools in the town of Windermere, Alberta. Students loved the classes, but Morgan needed a way to record and evaluate their learning progress. He found a solution while standing in line at the supermarket.

As he watched the bar-code scanner recording the price of his groceries, Morgan imagined that the same technology could also be used to assess student performance. Inspired by the idea, he invented a simple program called Learner Profile that allows teachers to record observations by swiping a bar code each time a student displays an observable trait such as offering a hypothesis or working well in a team. While Learner Profile isn't meant to replace standardized tests, the system allows teachers to efficiently collect and manage information that enhances a student's overall performance record. Learner Profile, which now runs on an Apple Newton, is used by nearly 10,000 teachers in the US, Canada, England, Scotland, and Australia. The program has also become the backbone of Morgan's educational software company, Morgan Media.



Gerry Morgan scans to see what's really inside.

ORIGINAL PHOTO: REX RYSTEDT

Authentic-assessment advocates have long criticized standardized tests, arguing that their purpose is largely political, rather than pedagogical. By training students to do well on these tests, they say, schools de-emphasize the skills kids really need.

Even the wonks at the Educational Testing Service, the SAT's authors, are catching on. "Traditional testing assesses the student's ability to answer well-structured, unconditional questions," says ETS research scientist Robert Mislevy. "The real critical skill is to be able to understand a problem and formulate it in a way that solutions can be devised."

Still, skepticism abounds. Mislevy says some authentic-testing methods are cumbersome because they require extensive teacher training. Even if a school can afford assessment technology, he adds, many worry that these methods rely too heavily on the subjective judgment of individual teachers.

Of course, for most parents, success in the college application process remains the ultimate measure of achievement. Yet even in admissions offices, support for more realistic assessment is growing. Stanford University is starting to take authentic assessment more seriously, according to Jon Reider, the school's director of admission, especially as technology makes qualitative data easier to digest. "The SAT will always be an important way to rank students," he says. "But if there is a system that synthesizes more qualitative information, then I think we can start to move away from such heavy reliance on standardized tests."

– *Rachel Lehmann-Haupt*

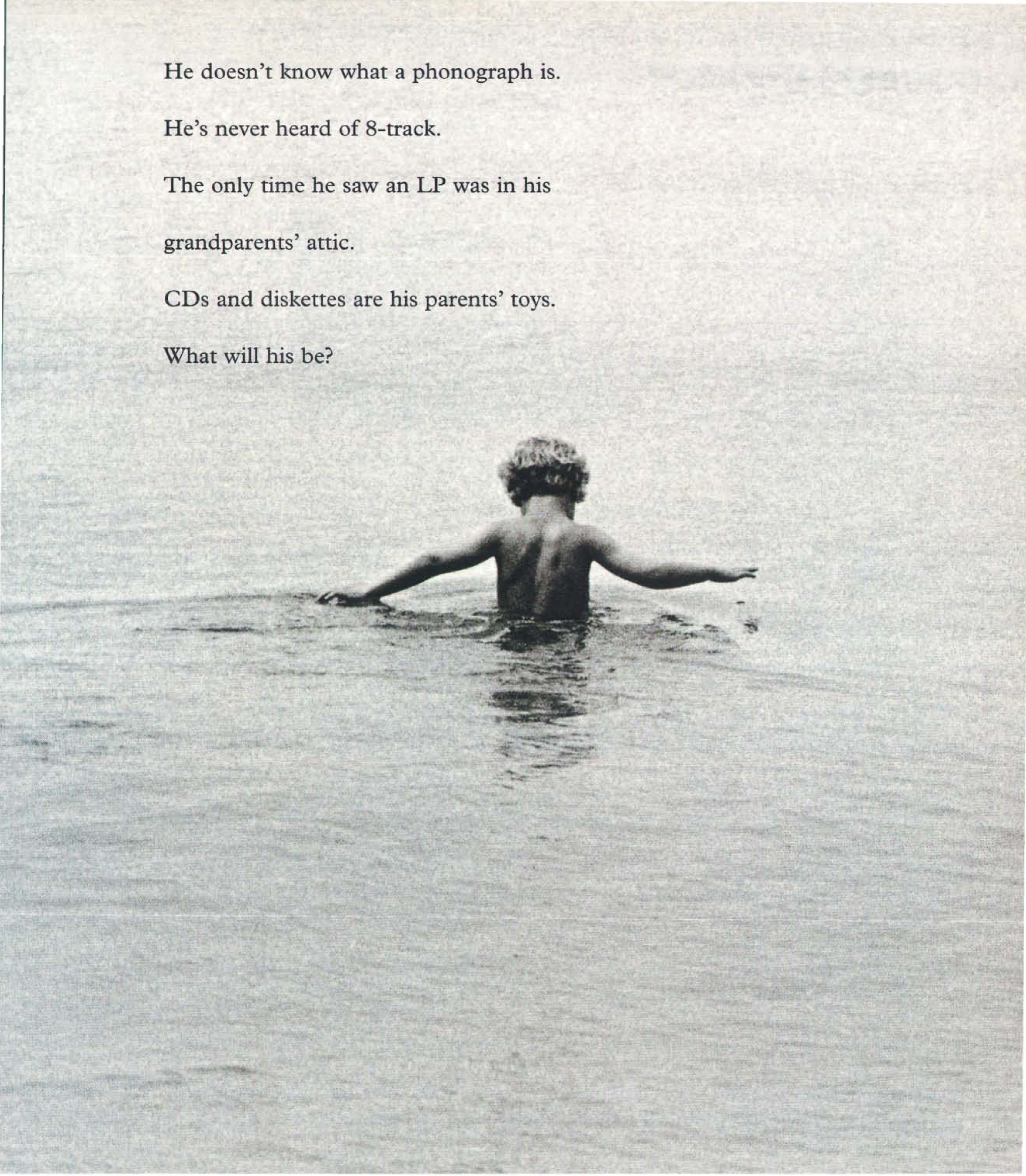
Wired Top 10

The Hollywood Stock Exchange's rising stars

Symbol	Name	Last Price	YTD % Change
1. GANDE	Gillian Anderson	$1,517	45.87
2. BPITT	Brad Pitt	$1,477	32.47
3. JGLDB	Jeff Goldblum	$1,386	32.00
4. WSMIT	Will Smith	$1,323	29.71
5. DDUGH	David Duchovny	$1,290	27.98
6. BWLLS	Bruce Willis	$1,347	27.68
7. JIRON	Jeremy Irons	$1,234	26.56
8. GRUSH	Geoffrey Rush	$1,264	26.40
9. THANK	Tom Hanks	$1,365	25.81
10. GOLDM	Gary Oldman	$1,242	24.82

Note: Figures in US currency.
Source: Hollywood Stock Exchange *(www.hsx.com/)*.

– *Gareth Branwyn*



He doesn't know what a phonograph is.

He's never heard of 8-track.

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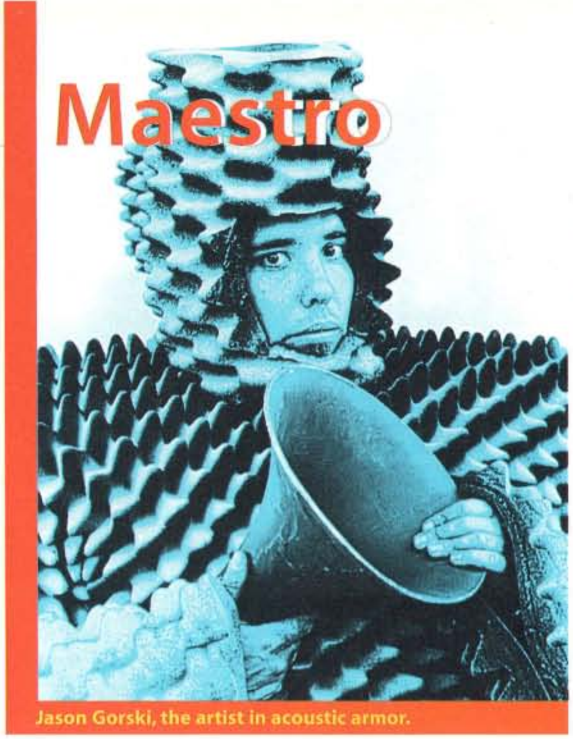
SONY

Foghorn Maestro



Jason Gorski, the artist in acoustic armor.

A howling wail that sounds like God's own saxophone freezes every human on the beach. All conversation within a mile stops dead. Some bystanders fret about an impending air raid. Others think a supertanker is lost in the San Francisco Bay's hovering fog. Fortunately, it's just another guerrilla concert performed by Jason Gorski, aka the Fogmaster, as he conducts his symphony of diesel-powered foghorns.

After moving to San Francisco in 1984, Gorski, 39, found work at the Exploratorium science museum, where he began tinkering with an old set of Coast Guard foghorns that had once warned mariners to stay away from the Bay's Angel Island. The vintage maritime signals had been retired, and Gorski managed to snag them on "permanent loan."

Weighing 65 pounds each, the horns are copper bells – 28 inches long, 20 inches wide, and containing a solid brass diaphragm 8 inches in diameter – that come to life with help from a diesel-powered air compressor. By varying the amount of air that reaches the diaphragm and by inserting objects into the bell, Gorski creates music that is overpowering but oddly seductive. Peaking at 140 decibels, the stomach-clenching volume and wild harmonics force the Fogmaster to wear head-to-toe protective clothing while performing his concerts. But from miles away, the sad, bellowing songs evoke longing and distraction.

A symphony of 140-decibel foghorns creates a sad, bellowing music that's oddly seductive.

Gorski's concerts tend to be spur-of-the-moment – and for good reason. During one recent performance, US Army police cars rushed to the end of an old pier near the Golden Gate Bridge where Gorski had set up his horns. Standing clear of the sonic shock waves, the cops pleaded with Gorski to end the show, but the maestro politely reminded the officers that no permit is necessary to conduct an acoustic performance. Then, with a wave of his hand, he allowed one more caterwauling blast to shred the damp night air. As the echoes died down, Gorski turned to the cops. "All right," he said with a smile. – *Allen Whitman*

The Wired Interactive Technology Fund (TWIT$)

Company	Primary Business	Symbol	Shares	Close Aug 1	Δ Since July 1	Action
Adobe Systems	Software	ADBE	5,000	37 3/4	+ 3	hold
Amazon.com	Online bookstore	AMZN	10,000	29	+ 10 13/16	sell
Biochem Pharma	Pharmaceuticals	BCHXF	10,000	28 1/4	+ 7	hold
Forte Software	Software	FRTE	15,000	10 15/16	– 1 11/16	hold
General Scanning	Laser technology	GSCN	10,000	17 7/8	+ 3 1/2	hold
Informix	Database sw	IFMX	6,675	10 5/8	+ 1 15/32	hold
Intel Corporation*	Microchips	INTC	3,000	93 5/8	+ 24 3/32	hold
Macromedia	Multimedia sw	MACR	14,000	8 23/32	+ 9/32	hold
Octel Communications	Voice hw/sw	OCTL	5,800	30 3/8	+ 7 3/4	hold
Premisys Communications	Telecom equip.	PRMS	17,000	20 3/4	+ 5 1/8	sell
Standard & Poor's 100 Index		OEX	20	4 3/8	– 12 1/8	hold
New Holdings						
Aware	Network hw/sw	AWRE	14,000	10 1/2		buy
Fore Systems	Network hw/sw	FORE	9,000	15 15/16		buy
Fusion Medical Technologies	Medical equipment	FSON	35,000	4 5/8		buy
Oak Technology	Microchips	OAKT	13,000	11 3/8		buy
PairGain Technologies	Network hw/sw	PAIR	7,000	23 1/8		buy
Cash Holding	$118,253.50					
Portfolio Value	$2,353,162.88	(+ 135.32% overall)			+ 20.27%	

* INTC split 2:1 on July 13, 1997.

Legend: This fund started with US$1 million on December 1, 1994. We are trading on a monthly basis, so profits and losses will be reflected monthly, with profits reinvested in the fund or in new stocks.

TWIT$ is a model established by *Wired*, not an officially traded portfolio. Jeffery Wardell (*jwardell@hamquist.com*) is an executive financial services representative for Hambrecht & Quist LLC who may have a personal interest in stocks listed in TWIT$. The opinions expressed herein are those of the author and not necessarily those of H & Q's research department. H & Q has not verified the information contained in this article and does not make any representations to its accuracy and completeness. *Wired* readers who use this information for investment decisions do so at their own risk.

Big for Small Caps

The TWIT$ portfolio benefited from raging technology stocks, gaining 20.27 percent for the month compared with the 5.09 percent increase in the benchmark Russell 2000 Small Cap Index.

It's time to take profits in Premisys and Amazon.com – the bookish stock appreciated more than 50 percent in one month based on agreements with Yahoo! and AOL.

Aware and PairGain give TWIT$ a pure play in the xDSL technologies that increase data speeds over standard copper wires. Cable modems will replace this technology eventually, but don't buy just yet – the cable companies hardly have an impressive track record for new technology deployment. Takeover rumors about Fore Systems have sent trading volumes up for this long-dormant stock. And specialty chip maker Oak Technology has private investments in Taiwanese foundries that I believe are underappreciated. The final addition is Fusion Medical, which recently hired away Chiron's CFO. Fusion is developing surgical sealants and should start getting attention from the Street shortly. – *Jeffery Wardell*

PHOTO ABOVE: KIP DUFF

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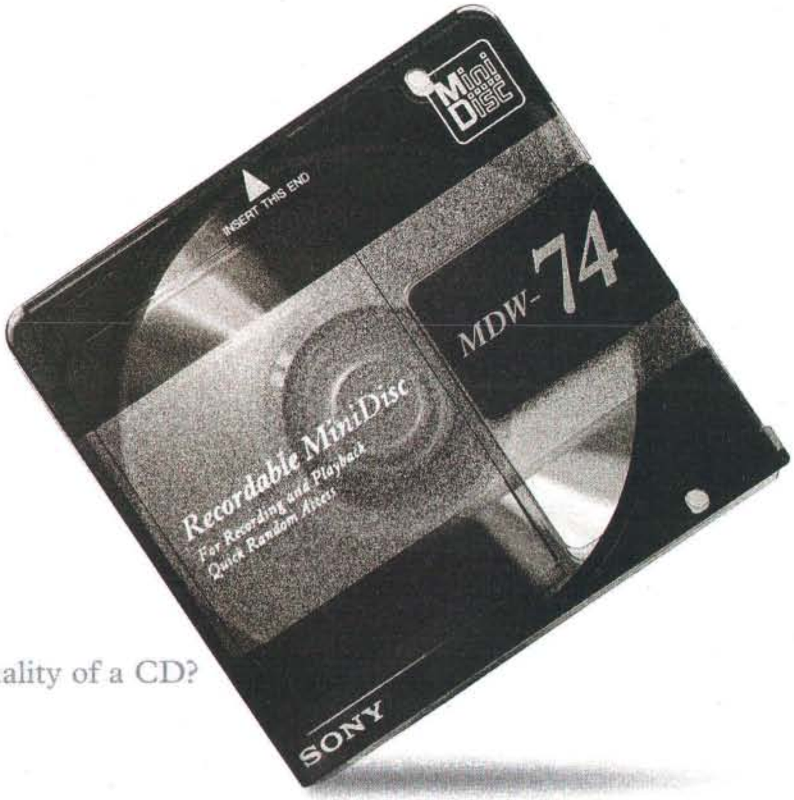
next
is
now.™



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SONY

By Steve Steinberg

Hype List

Deflating this month's overblown memes.

1

Online Chat ▼

Venture capitalists travel in herds, stampeding from one technology to the next. But look at past technologies they have embraced en masse, from pen computing to Internet push companies, and you'll realize that VCs may be the best contrarian indicator around. And even if you didn't know that they're circling Internet chat start-ups like vultures, you'd probably still figure out that this technology is a loser. Instant-messaging programs combine the worst aspects of the media it hopes to replace: the interruptive nature of telephone calls and the laborious typing of email.

2

Embedded DRAM ▲

With memory-chip supply outpacing demand, DRAM manufacturers have been feeling the pinch. So it's no surprise that they are touting embedded DRAM as the second coming. Combining logic and memory – essentially putting a microprocessor on a DRAM chip – would allow manufacturers to escape from their grubby subsistence. There's just one problem: The Japanese and Korean conglomerates know nothing about processor design, and US companies are rank amateurs in the black art of DRAM design. Given the paranoia about trade secrets on both sides, a successful partnership between memory and logic looks awfully unlikely.

3

Space Race ▼

Beyond the Mars Pathfinder project, space fever is busting out all over. From paranoid tales of Grays and alien abductions to rumors that rapid wealth accumulation in Silicon Valley has spurred the development of privately financed space programs (á la *Moonraker*, perhaps?), outer space is replacing cyberspace as the destination of choice. But the technologies behind both environments make the same transcendental promise: escape from the stink of humanity. And both will end up disappointing. Whether it's the human trash that orbits Earth, or the pornography and pettiness that covers the Internet, humanity always comes with us.

4

Voice Over IP ▲

According to rabid Netheads, making a call over the Internet is inherently cheaper than using a conventional phone, thanks to the Net's superior technology. A nice idea, but too bad it's fantasy. The Net is an inexpensive pipeline largely because ISPs dodge taxes borne by telephone companies. And it sacrifices reliability for low cost. But telephone companies are headed for extinction anyway. With the amount of data traffic growing almost a hundred times faster than voice traffic, the telephone network will soon be no more important than the Telex network.

5

Teletubbies ▲

Without a doubt, the strangest thing about the Teletubbies – those antennaed, acid-colored dancing creatures with names like Tinky Winky and Laa Laa – is that they are a product of BBC television. We're used to bizarre TV shows from Japan – such as the *Mighty Morphin Power Rangers* – but from staid old England? One viewing of *Teletubbies* will erase any doubt that house culture and ecstasy have irreparably changed the UK's social chromosomes. Expect this show to be huge once it starts appearing on US television. The only question is, who will tune in more – its intended audience of five-year-olds, or stoned twentysomethings?

▲= meme on the rise
▼= meme in decline

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The Future of Physical Fitness

You've heard the hype. We asked the experts. Here's the *real* timetable.

Pants feeling a little bit snug? You're not alone. According to a recent Harris poll, three out of four Americans above the age of 25 are carrying a couple extra pounds. Thankfully, a battery of scientists, personal trainers, and engineers are watching your weight even if you're not. Exercise machine manufacturers, taking a cue from the likes of Nintendo, are turning treadmills into videogames. And gymwide intranets promise to regiment and track your workout routines. *Wired* asked several exercise experts how the future of physical fitness is shaping up.

	Fitness-Machine Connectivity	Safe and Effective Muscle-Building Pill	Multiuser Exercise Videogames Catch On	America Gets into Shape
Benjamin	1999	unlikely	1999	2000
Giannelli	2000	2007	2002	2002
More	1990	2030	1989	2040
Scalisi	2010	2020	2020	2050
Bottom Line	2000	2022	2003	2023

Mike Benjamin
president of Tectrix Fitness Equipment

Ray Giannelli
vice president of research and development at Cybex

Natasha Vita More
bodybuilding guru and founder of Transhumanist Art and Extropic Art movement

Vincent Scalisi
editor of *Muscle & Fitness* magazine

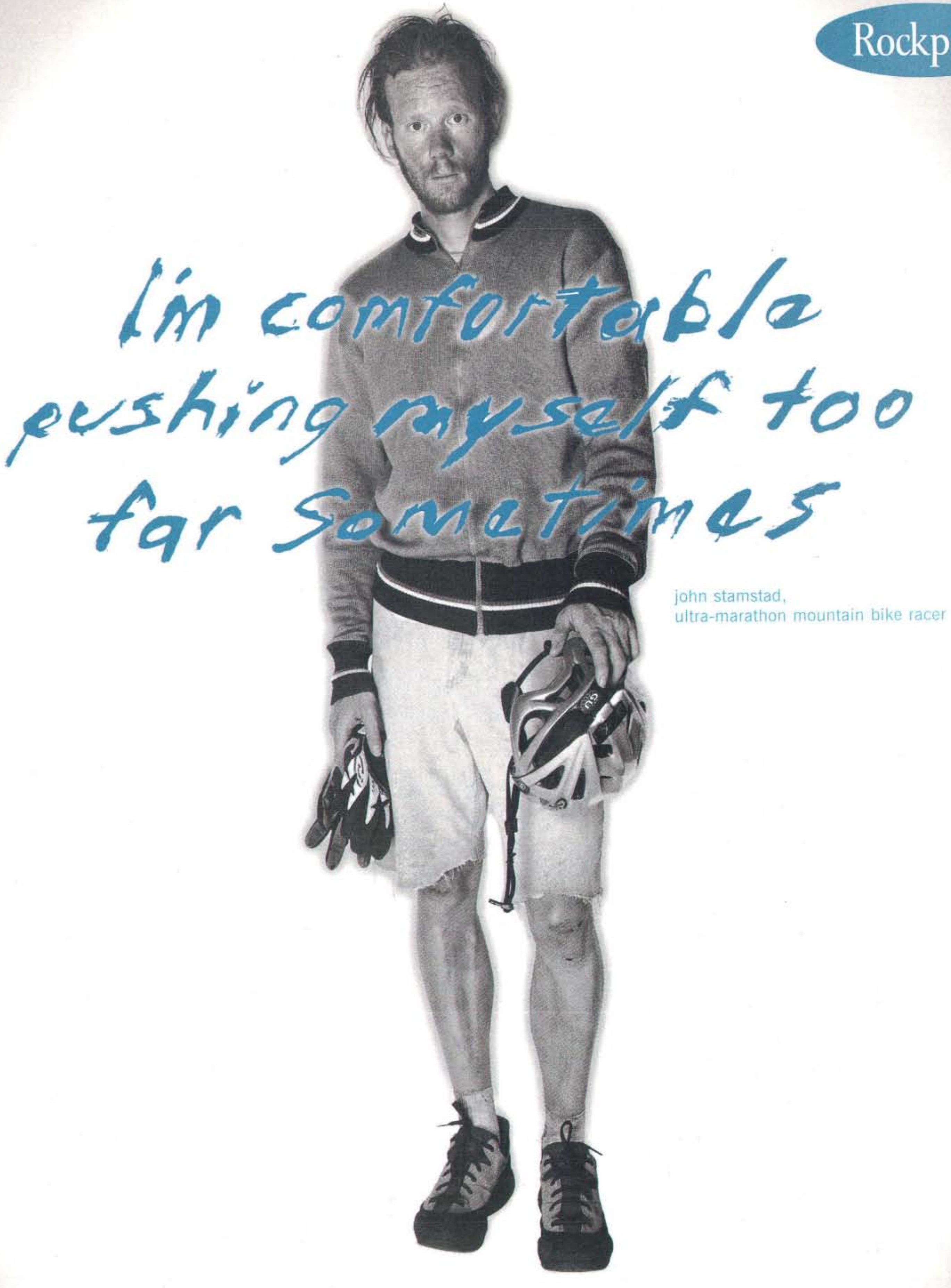
In a dusty corner of most fitness centers lies a file box filled with empty cards, originally created to detail each member's personalized workout regimen and physical development. Couldn't a central computer and an array of connected machines keep better tabs on you? Several companies, our experts point out, have built high tech fitness stations and smartcards that track your progress, but they haven't caught on yet. Benjamin expects that insurance companies – focused on "discounted individual policies and subsidies to companies for records of fit people" – will drive this trend. The next step is for the systems to recognize users, adjust the seat position accordingly, select the correct weight, and coach individuals through each set. "This is where Orwell meets Schwarzenegger," Scalisi says, only half joking.

Muscles in a pill? Don't give up those curls and squats just yet. Safety is the key term here, which puts anabolic-androgenic steroids out of the running. Giannelli says that a nontoxic muscle-growth pill is far from reality, considering that "we don't even have a safe sugar alternative today." Scalisi and More agree that something can be said for supplements like creatine monohydrates, which increase the internal volume of muscles by binding water molecules to their cells. "But the results are temporary," Scalisi warns. Perhaps more imminent than muscle-building pills are advanced "prosthetic muscle-mass augmentation implants," says More. Addressing the question succinctly, Benjamin opines, "What makes muscles? Using them."

As anyone who has spent 45 minutes climbing the stairs to nowhere can tell you, exercise machines are boring. What will top today's state-of-the-art gym technology, which typically consists of a TV installed in front of a treadmill? Try fierce competition in the form of multiuser exercise videogames. Benjamin believes that games more complex than networked rowing machines – say, the four-player soccer-like pastime that his company has introduced – will draw the crowds. Doubtful, say other experts. "Participating in a competitive sport while investing in one's own fitness program detracts from goal-setting," More says. Even if your goal is more, um, social, don't bet on scoring in the heat of a multiuser fitness game. "Most people go to health clubs today just to work out," Giannelli says, with a straight face.

Purchasing a gym membership is only half the battle, and the US seems to be losing the war. But three factors will help get the United States into shape in the future. The first is the incorporation of designer foods into our diets. "They can satisfy our cravings for sweets and fatty foods, while providing virtually no calories," Scalisi says. "We will have our cake and eat it too." His other two dream technologies are metabolic regulators and virtual reality home gym equipment, which Benjamin agrees is the key to raising heart rates. "People will think getting fit and having fun are synonymous," he says. Giannelli, however, is more skeptical. "In the age of two-income families where time is our most precious commodity, I guess we haven't prioritized fitness very high on the list," he says.

3-D DATA SET COURTESY Viewpoint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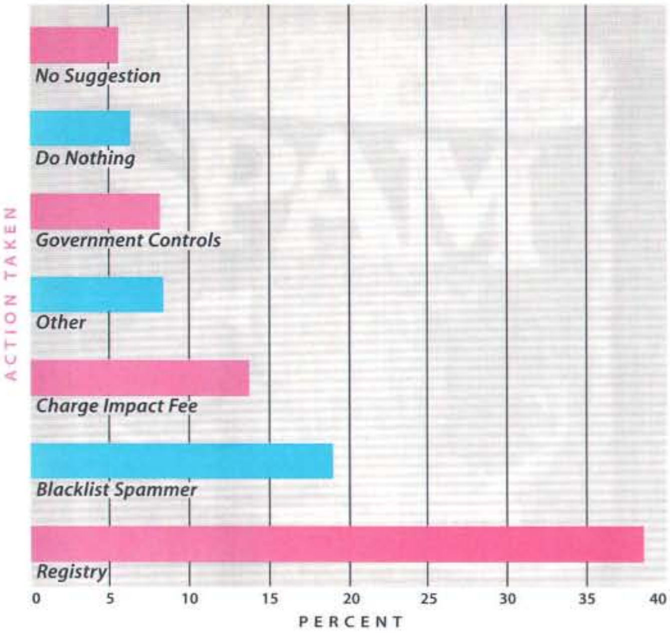
Punishing Spammers

Unsolicited email bombards us daily with inane marketing chatter. Sixty percent of us delete spams without reading them, yet only 5 percent retaliate. The most popular antispamming solution in a recent Georgia Tech survey was an "opt out" registry – a stopgap measure at best since tolerance for spamming is declining fast, begetting the need for harsher measures in the future.

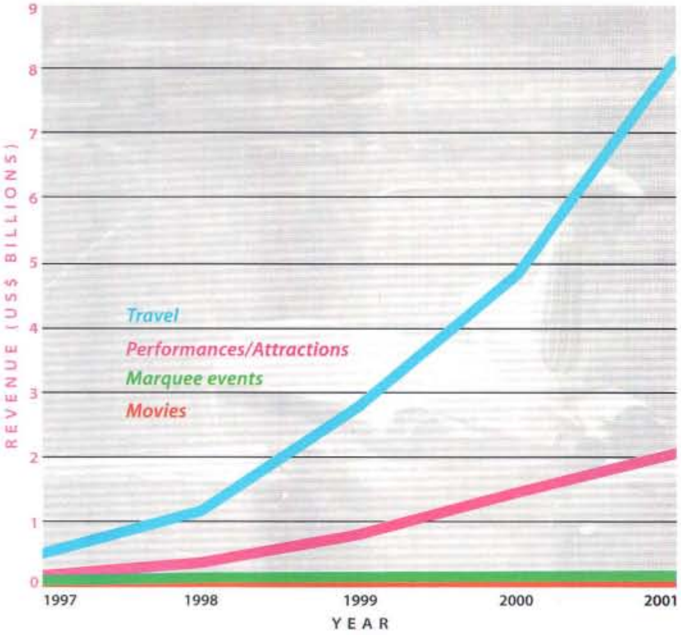
SOURCE: GRAPHICS, VISUALIZATION, & USABILITY CENTER'S SEVENTH WWW USER SURVEY



Online Tickets

Still calling your travel agent to book airline tickets? Well, hang up and log on. Researchers interviewed a cross section of companies and one-third said they hope to garner at least 10 percent of ticket sale revenues via the Web by 2000. Just think – soon we'll be booking our vacations without having spent 25 minutes on hold listening to United Airlines theme music.

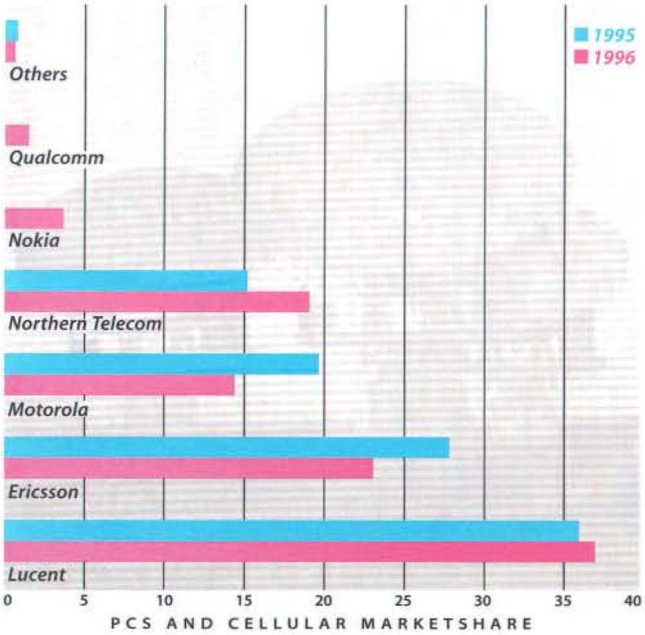
SOURCE: FORRESTER RESEARCH INC.



Wireless Marketshare

PCS markets are booming. Wireless revenues grew close to 65 percent last year to US$5.3 billion, while spending on PCS infrastructure jumped an impressive 500 percent to $2.8 billion. Growth is expected to continue this year, with smaller companies like Nokia and Qualcomm entering the market. But because of extremely high start-up costs, only a handful of major players will cash in.

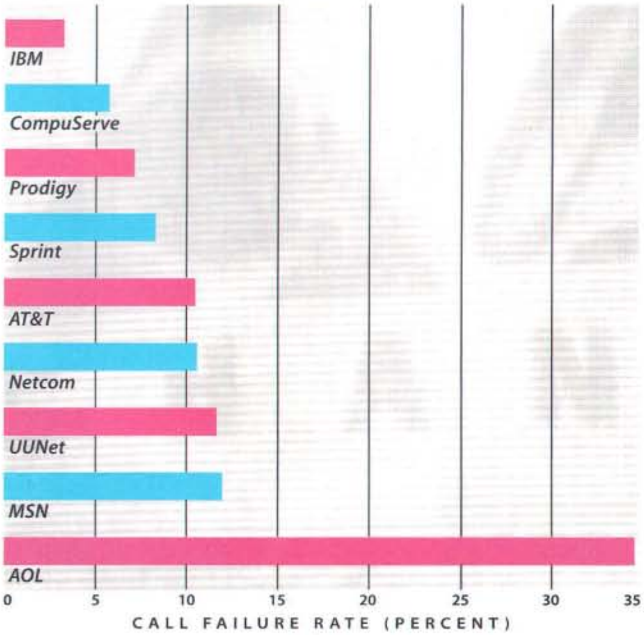
SOURCE: DATAQUEST



America Offline

OK, your PC is configured, modem's connected. You click the mouse, send the command, wait ... nothing. Chances are, this has happened to you. And if you're one of AOL's 8 million users, it has happened to you a lot – say, 34 percent of the time. While the figure is down from 80 percent in January, connecting to the online behemoth is still hit-or-miss compared with its competitors.

SOURCE: INVERSE NETWORK TECHNOLOGY INC.



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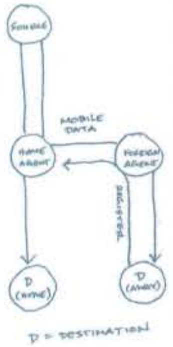
You Make the Protocol

Active nodes and networks.

By Kenji Morrow



The ANTS networking scheme supports mobility. In the diagram above, one type of capsule is sent by the mobile user to register forwarding information. Another capsule is used to send messages to this roaming host.

Industry consensus holds that the current foundation of the Net, Internet Protocol version four, hasn't been up to the task since the early '90s. While attempting to accommodate new technologies, such as the latest firewalls and video-streaming programs, the Internet Engineering Task Force standards committees have tweaked IPv4 on an ad hoc basis. But the Net is being used in new ways every day, which requires as many new protocols, and this house of cards can't stand much longer.

However, the effort to fast-track the next-generation Internet Protocol, IPv6, through the standards committees creates a whole different set of problems. Currently, the IETF is rolling many of IPv4's modifications into version six, while at the same time neglecting other more controversial network protocols. So, for example, IPv6 contains expanded address space and a crude packet prioritization system, but it doesn't guarantee support for multicasting and mobility by all nodes.

If the Net is to continue to grow at its current pace, it needs a more organic means for creating new protocols. With funding from Darpa, MIT researchers David Wetherall, David Murphy, and John Guttag are building the Active Node Transport System (ANTS), an active network architecture that allows for spontaneously generated protocols. Under their scheme, new protocols won't be born in vendor boardrooms or incubated in stodgy standards committees; instead, they'll be quickly generated and easily distributed over smart networks.

ANTS is the framework – a meta-protocol, really – for an active network whose nodes, which include all the routers and end systems, are completely programmable. This architecture relies on mobile code technologies like Java to turn the Net into a distributed programming system. The key component to this architecture is the capsule, an update on today's packet. Capsules contain header information and data, the same way packets do, but they also contain something new – code.

Today, the network router is the traffic cop of the Internet. It receives packets, queues them until the destination can be processed, and then sends them on their merry way. But networks are capable of much more than storing and forwarding packets. In an active network, the active nodes serve not only as routers – supplying the processing power that the capsules need to get to their destinations – but also run the instructions contained in the capsules.

So active nodes can receive incoming capsules, hold them until other needed payloads arrive, and cache any application-specific objects. Working within such a network, individual developers would be able to implement protocols to suit their own needs. There would be no need for industrywide consensus before Sega implemented a gaming network protocol or a company like Norton moved its desktop utilities onto the network. The network would dynamically assemble needed protocols and install them itself.

Capsules contain instructions and identifiers that point the nodes to the source of a new network protocol. To run a capsule's code and process its content, active nodes first load the instructions from the source. In the instance where the instruction set is too large to be housed in a single capsule, partial instructions are cached in the node until the next capsule arrives. The process is similar to the way browsers use URLs to locate, download, and cache Web pages.

Used in conjunction with IPv6, active networking could produce big payoffs. Mobile computing, for example, would become easier to implement. Using cooperating capsules, it's possible to send data to a mobile network node. Data heading for its home destination could be dynamically redirected as the capsules are processed by nodes. This eliminates the problems caused by several protocol layers or multiple hardware interfaces.

Mobile computing is one promising application, but there are many other compelling reasons for active networks. Working over an active network, two remote users could opt to expend extra processing power to decrease their transmission's bandwidth. To facilitate faster network speeds, capsules could perform compression at the network level without having to rely on client or server applications. Instead of developers having to build compression schemes into programs like RealAudio, the network would do the work itself. Capsules on both sides of the connection would transparently handle compression, and the specific application – audio streaming, in this instance – could focus on its core function.

Despite this promise, a few problems must be ironed out before we can expect to see the widespread adoption of active networking. Having millions of people creating their own protocols raises serious security issues. Also, because Java isn't native to any mainstream computing hardware, it runs very slowly. Once Java technologies mature and the active node services are written in C, the speed and practicality of active networks will improve dramatically.

While these problems must be resolved before Wetherall, Murphy, and Guttag can implement their scheme, other research portends arrival of similar active network technology. At the University of Arizona, computer scientists are working on x-kernel. Under their architecture, protocols are broken down into behaviors that are combined in the kernel of a node's operating system. New protocols are added as conglomerations of these behaviors, which are essentially combinations of the same set of variables. While the active network allows the Internet to become programmable, x-kernel makes it configurable.

As IPv6 is phased in over the next few years, an active version will likely trail close behind. Active IP will initially find its way into the networks run by large ISPs, but as the demand for its versatility increases, the technology will trickle down. Of course, the true test of its success will be the willingness of vendors to support Active IP in their hardware. Most likely, the Ciscos and Ascends will initially balk at implementing such radically different network technology. But you can bet your dumb router that if the big companies don't see the benefits, some other more enterprising outfits will. ■ ■ ■

Kenji Morrow can be reached at kenji@trench.com.

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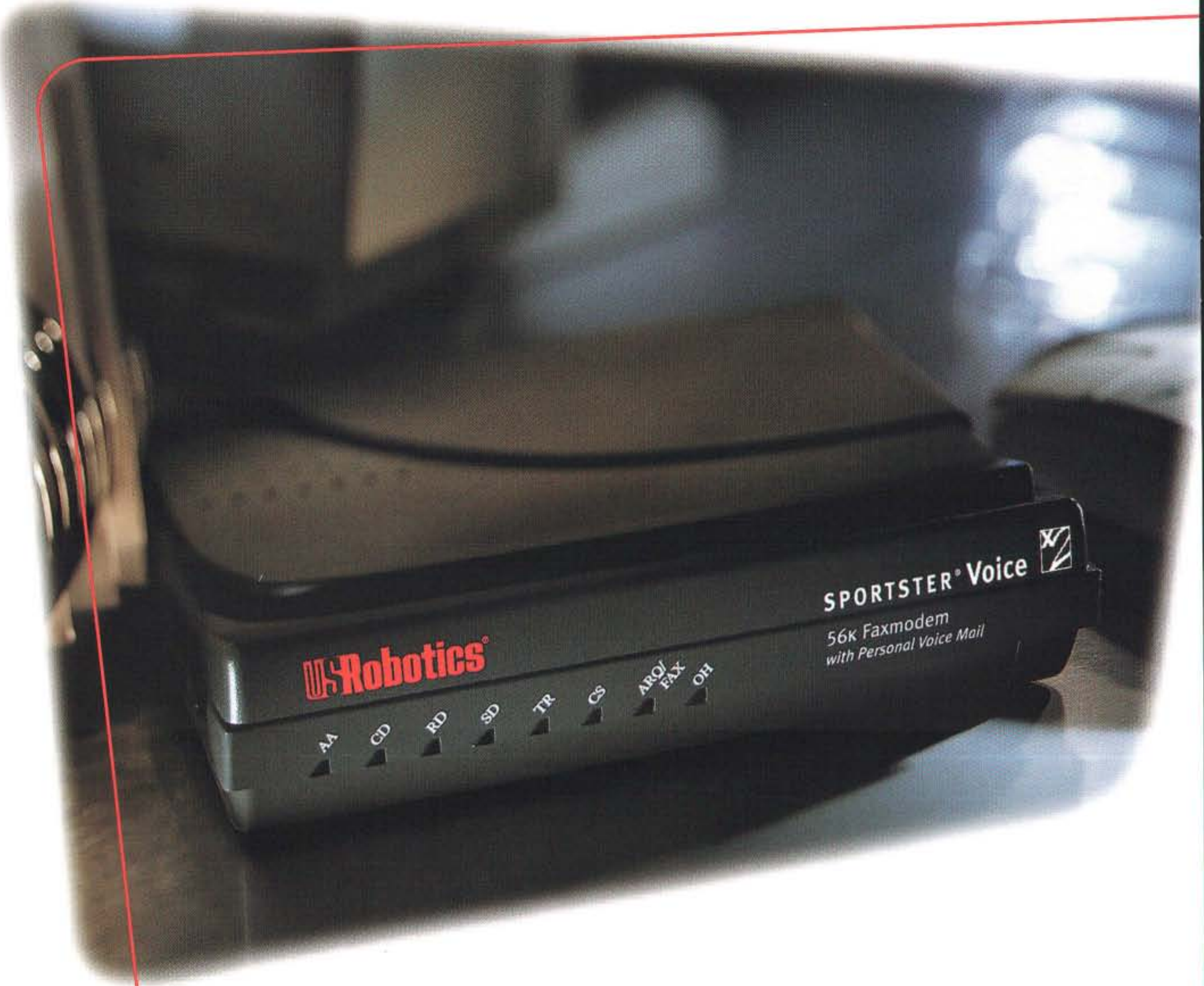

$50 (US) rebate offer replaces previous free month of ISP service (up to $25 US) for U.S. Robotics desktop modems only. Original free month of ISP service offer still applies to Megahertz® 56K PC Card modems, models XJ1560, CC1560, XJ5560 and CC5560.

1 All x2 products are capable of 56 Kbps downloads; however, due to FCC rules which restrict power output of service providers' modems, current download speeds are limited to 53 Kbps. Actual speeds may vary depending on line conditions. Uploads from users to providers travel at speeds up to 28.8 Kbps.
2 An x2-capable modem, an x2-compatible analog phone line and an x2-capable service provider are required for these high speed downloads. See www.usr.com/x2 for details.
3 Guaranteed upgrade valid for all currently available Sportster® 56K faxmodems (Models 1783, 1784, 1785, 1786, 1787 and 1789), Courier™ 56K faxmodems (Models 1867, 1868 and 1869) and Megahertz PC Card modems (Models XJ1560, CC1560, XJ5560, and CC5560). This offer valid in the U.S. and Canada only. Upgrades must be claimed by 6/30/98.

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x2™ Delivers...even more.

x2 Delivers...cash back and more

Every day, more and more information is added to the Internet. Like bigger data files, and richer graphics. You're going to need a faster modem than the 28.8K and 33.6K models out there now.

That's why we're making it easier for you to get the x2 technology 56K[1] modem, the fastest ever created for use with regular phone lines – by giving you $50 (US) cash back.

x2 Delivers...high download speeds now

You don't need to wait to take advantage of this modem's superior download speeds. That's because x2 technology has already received the support of more than 800 Internet service providers (ISPs), from industry giants like IBM Global Services, America Online, Prodigy and NETCOM to smaller regional providers. In fact, more than 700 of them are live today, offering local access. That means you can start downloading at high speeds in all 50 states right now with x2.[2] It's that simple.

x2 Delivers...free upgrade to standard

You may have heard that the international 56K modem standard hasn't yet been defined (expected in 1998). That's why we're offering a no-risk guarantee of a free upgrade to make your x2 modem meet this new standard after it's approved. And since x2 uses DSP Solutions technology from Texas Instruments, it can easily be software upgraded to receive future performance enhancements as they're developed.

x2 Delivers...guaranteed

To make it easier for you to experience x2 technology now, we're introducing "x2 Delivers More," a special program that will show you why buying an x2 modem now makes so much sense.

x2 Delivers...more!

$50 (US) CASH BACK

Now, instead of a free month of Internet service, we're offering a $50 (US) mail-in rebate when you purchase a U.S. Robotics x2 technology 56K desktop modem by 10/4/97. It's a great way to help you get even more out of the Internet.

CONNECT NOW in all 50 states and Canada

Right now, more than 700 ISPs are live with x2, so you can connect regardless of where you live.[2]

FREE UPGRADE to standard[3]

After the new 56K ITU-T standard is approved, we'll upgrade your U.S. Robotics x2 technology 56K modem to meet it — absolutely free.

30-DAY money-back guarantee

We're confident you'll be completely satisfied with your new x2 modem. If not, you can return it with your dated receipt within 30 days of purchase — no questions asked.

See the back cover for complete details of the x2 Delivers More program.

x2 Delivers...an easy choice

The ability to connect now in all 50 states and Canada. $50 (US) cash back. A free upgrade to standard. A 30-day money-back guarantee. It simply couldn't be any easier. For more information, visit our Web site at **http://x2.usr.com/connectnow**, or call **1-800-525-USR1** to find an ISP near you that offers live x2 service.

Now download at high speeds with the company that connects more people to the Internet than any other. To get the speed you need, just remember one thing: x2 delivers even more than before.

U.S.Robotics®

x2 TECHNOLOGY.

U.S. Robotics. From the leader in networking. 3Com x2™ Delivers ...more!

$50 (US) CASH BACK WHEN YOU BUY x2 TECHNOLOGY NOW
CONNECT NOW WITH MORE THAN 700 LIVE ISPs NATIONWIDE
FREE UPGRADE TO 56K ITU-T STANDARD
30-DAY MONEY-BACK GUARANTEE

Buy any Sportster® or Courier™ 56K modem with x2™ technology between July 1 and October 4, 1997 and get $50 (US) cash back plus upgrade to 56K ITU-T standard,[1] FREE. And if you're not satisfied after 30 days you can return the modem for a full refund.

To get your $50 (US) cash back, just complete and return the form below.

Then, you'll also be registered for the free upgrade. After the ITU-T standard for 56K modems is approved, we'll upgrade your U.S. Robotics x2 technology 56K modem, free of charge. Since every x2 modem is equipped with Flash ROM, we expect the upgrade to be as simple as a software download from the Internet. If it's not, we'll replace your modem with one that does meet the new standard – free of charge. Register your modem, and after the 56K standard is approved by the ITU-T, we will notify you how and when to get your free upgrade. Approval is expected some time in early 1998.

And again, if you're not satisfied with your U.S. Robotics x2 technology 56K modem, simply return it within 30 days of purchase, along with dated receipt, to the store or mail order reseller where you bought it for a full refund.

This offer supersedes all other preceding x2 offers for Sportster and Courier desktop modems. Free month of Internet service offer still applies to Megahertz® 56K PC Card modems.

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[1] Guaranteed upgrade valid for all currently available Sportster 56K faxmodems (Models 1783, 1784, 1785, 1786, 1787 and 1789), Courier 56K faxmodems (Models 1867, 1868 and 1869) and Megahertz PC Card modems (Models XJ1560, CC1560, XJ5560 and CC5560). This offer valid in the U.S. and Canada only. Upgrades must be claimed by 6/30/98.

U.S. Robotics® x2 TECHNOLOGY

$50 Cash Back

TO HELP ENHANCE YOUR INTERNET EXPERIENCE

Get $50 (US) cash back from U.S. Robotics

To get your $50 (US) cash back:

1. Buy any Sportster or Courier modem listed below between July 1 and October 4, 1997.
2. Fill in all requested information on this form.
3. Enclose this completed form with a copy of your dated modem receipt, original UPC bar code symbol and serial number from the modem package (see samples below) and mail to:
   U.S. Robotics, x2 Delivers More, PO Box 8131, Young America, MN 55551-8131

Any questions regarding this program, please call 1-888-390-6863.
This offer supersedes all other preceding x2 offers for Sportster and Courier desktop modems. Internet service offer (up to $25 US) still applies to Megahertz 56K PC Card modems.

(Please print all information clearly.)

Name ______________________________

Address ______________________________

City ______________ **State/Prov** ______________ **ZIP/Post** ______________

Phone ______________ **E-mail Address** ______________

Retailer / Mail Order Reseller where modem purchased ______________________________

$50 (US) cash rebate offer valid with purchase of Sportster 56K Faxmodem models 1783, 1784, 1785, 1786, 1787 and 1789; and Courier 56K Faxmodem models 1867, 1868 and 1869 only; purchased between July 1 and October 4, 1997. Offer not valid with Megahertz PC Card modems. Request must include copy of dated modem sales receipt, actual UPC bar code and serial number from the modem package. Not responsible for lost, late or misdirected mail. Request must be postmarked by November 15, 1997. Valid in U.S. and Canada only. **Not valid with any other offer.** Please allow 6 to 8 weeks for receipt of check.

UPC SAMPLE

x XXXXX XXXXX x

SERIAL NUMBER SAMPLE

21NG23xxxxxx

The following UPC codes are the only acceptable codes for this offer. No other UPC codes are valid. Tape UPC bar code over this box.

7-38168-00611-3 7-38168-00612-0 7-38168-00613-7 7-38168-00614-4
7-38168-00615-1 7-38168-00616-8 7-38168-00630-4 7-38168-00629-8
7-38168-00682-3 7-36168-00686-1 7-36168-00669-4 7-36168-00670-0
7-36168-00687-8

Tape serial number & bar code over this box.

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WIRED NEWS

Once every thirty days, WIRED Magazine brings you the people and stories that define the digital world. Thirty times every day, WIRED News on the Web breaks the headlines that drive the issues. With up-to-the-minute reports, WIRED News brings an insider's perspective to the convergence of technology, culture, business and politics. **Get ahead. Stay ahead.**

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Digital Design

Living Surfaces Conference.

If a conference's quality can be divined from its lineage, then the American Center for Design's Living Surfaces: Toward Digital Literacy is shaping up to be a fantastic festival of binary beauty. The event's co-chairs, *I.D. Magazine*'s Chee Pearlman and Doris Mitsch, cofounder of Doris and Clancy Ltd., have assembled an impressive group of computer visionaries to expound upon the neo-esthetics of interactive media.

***Wired*'s own John Plunkett and Wired Digital's Barbara Kuhr will explain the trials of developing a unified design scheme for symbiotic print and Web publications. At the other end of the design/content spectrum, Denise Caruso plans to lead a tour of the editorial side of the virtual landscape. Caruso, a *New York Times* writer and an analyst for Interval Research, is known for cutting through the prevailing techno hype and framing up-and-coming issues.**

Microsoft's Linda Stone, who last year described the difficulty of designing a-life avatars, will once again help fill the geek quotient at this year's event. So will Purple Moon's Kristee Rosendahl, who plans to tackle identity, gender, and other complex issues when she discusses the design problems she faces while crafting PC games specifically for girls.

In all, this confab is meant to cover not just the changes in the way designers work as a result of new technologies, but also the changes that computers have wrought upon work itself. "When people used to talk about digital media, they meant using computers to create print and film," Mitsch says. "Now, we're not only designing familiar things using computers, we're also making things that until recently didn't exist."

Whisk away to the Windy City and find out what the glitterati are creating today.

Registration: US$565 through October 24 and $665 after. Contact: +1 (312) 787 2018, fax +1 (312) 649 9518, email *progsdir@aol.com*.

NOVEMBER 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 *DECEMBER* 1 2 3 4 5 6 7 8 9 10 1

Chicago's Inner and Outer Beauty

Way back in 1969, the Chicago Museum of Contemporary Art featured the artist Christo's first building wrap in the States. Last year, the institution moved into a new building designed by architect Josef Paul Kleihues. Today, the museum sports a stunning example of the Chicago Modern style, so the edifice doesn't really need to be covered up.

Lest you think that the museum's beauty is a mere façade, check out some of the shows to be held this December. Jasper Johns, widely recognized as the father of pop art, has an exhibition. And Toshio Shibata, a photographer known for gelatin silver prints that depict structures at odds with the natural environment, will receive his first American solo exhibition during the same period.

This winter, gawk at Chicago's architectural wonder known as the Museum of Contemporary Art, and then hurry into its heated galleries, where some paintings and photographs will provide the perfect complement to the digital dissections at the Living Surfaces conference.

The Current Roundup (see *Wired* 5.09)

October 22-24 Avatars '97; San Francisco. ▪ **October 23-25** Images of Politics: History and Development of Political Communication on Television; Amsterdam. ▪ **November 3-8** Globecom '97; Phoenix. **November 6-8** The Politics of Access to Computer-Assisted Education; Chicago. ▪ **November 8-14** ACM Multimedia '97; Seattle. **November 12-14** Interactive Publishing Europe; Zurich.

November 8-9 **Animation: An Exploration of Japanese Anime; Banff, Canada** The Banff Centre for the Arts in Alberta has commissioned an all-star lineup of *anime* impresarios, including Osamu Tezuka, Masumune Shirow, and Shigeru Miyamoto, to demonstrate the fantastic power of this genre of Japanese animation. Featuring film screenings and demonstrations by the Museum of Video Games, this graphical gala will display the wonders of the art form in all its supernatural glory. Registration: US$300. Contact: +1 (403) 762 6180, on the Web at *www-nmr.banffcentre.ab.ca/*.

November 13-15 **Bionomics: Living with Perpetual Evolution; San Francisco** According to this event's Cato Institute organizers, economic activity can be predicted and accounted for by employing certain biological models. Discussions, including those by telecommunications analyst Peter Huber and sci-fi author Gregory Benford, will focus on how individual and corporate organisms can cope with technological evolution. Registration: price unavailable. Contact: +1 (202) 789 5296, email *jbriggs@cato.org*.

November 20-21 **Online Games '97; Los Angeles** This seminar hopes to discover new revenue models for Internet-based gaming. Last year, 3DO's Trip Hawkins and executives from Sega, Mpath, and TEN explained how to battle into the black in the TCP play arena. This year's event will offer similar insights and a demo panel, which will introduce newcomers in the developing webutainment industry. Registration: US$1,290. Contact: +1 (212) 780 6060, email *jupiter@jup.com*, on the Web at *www.jup.com/*.

November 27-29 **The Virtual Campus: Trends for Higher Education and Training; Madrid** This education extravaganza, sponsored by the International Federation for Information Processing, offers the latest research into distributed learning environments. Held at the Spanish Distance Learning University, this event provides an opportunity to schmooze with educators from faraway lands. Registration: about US$175. Contact: +34 (1) 398 7993, fax +34 (1) 398 6028, on the Web at *www.ieec.uned.es/~ifip97/*.

December 3-6 **Living Surfaces: Toward Digital Literacy; Chicago** See information at left.

December 4-5 **The Impact of the Internet on Communications Policy; Cambridge, Massachusetts** Haahvard University's John F. Kennedy School of Government sponsors this wonkathon, which invites prominent scholars and high-level government officials to speculate on the coming changes in communications policy resulting from the meteoric ascent of digital information technologies. Registration: US$495. Contact: +1 (617) 496 1389, fax +1 (617) 495 5776, email *nora_o'neil@harvard.edu*.

The Usual Suspects

November 17-21 Comdex/Fall '97; Las Vegas. Contact: email *sell@comdex.com*, on the Web at *www.comdex.com/comdex/*. **December 9-12** Seybold Seminars Tokyo; Tokyo. Contact: on the Web at *www.seyboldseminars.com/events/*. ▪ **December 8-12** Fall Internet World 97; New York. Contact: on the Web at *www.events.internet.com/fall97.html*.

Got a good junket? Email junkets@wired.com.

ILLUSTRATION: TONY KLASSEN

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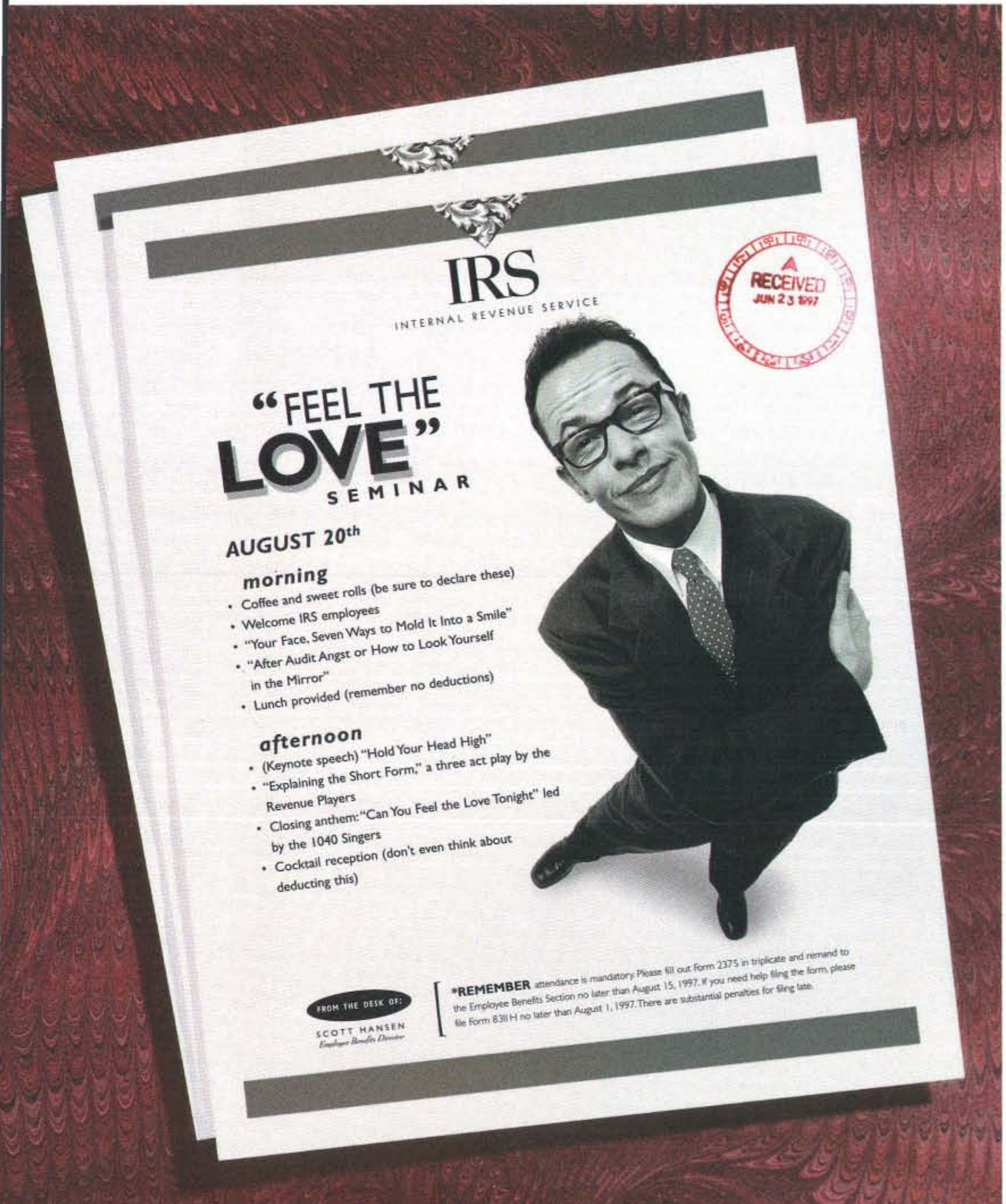

IRS

INTERNAL REVENUE SERVICE

RECEIVED
JUN 23 1997

"FEEL THE LOVE" SEMINAR

AUGUST 20th

morning

- Coffee and sweet rolls (be sure to declare these)
- Welcome IRS employees
- "Your Face, Seven Ways to Mold It Into a Smile"
- "After Audit Angst or How to Look Yourself in the Mirror"
- Lunch provided (remember no deductions)

afternoon

- (Keynote speech) "Hold Your Head High"
- "Explaining the Short Form," a three act play by the Revenue Players
- Closing anthem: "Can You Feel the Love Tonight" led by the 1040 Singers
- Cocktail reception (don't even think about deducting this)

FROM THE DESK OF:
SCOTT HANSEN
Employee Benefits Director

***REMEMBER** attendance is mandatory. Please fill out Form 2375 in triplicate and remand to the Employee Benefits Section no later than August 15, 1997. If you need help filing the form, please file Form 831I H no later than August 1, 1997. There are substantial penalties for filing late.

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PageWorks™ from Minolta. The most affordable laser printers in their class.

If your business could use some help with its image, consider Minolta's PageWorks monochrome line of laser printers. The PageWorks 20 may be the best value in network laser printers. It boasts a hefty 100MHz processor for maximum quality and throughput speed (20 ppm), heavy duty cycles, and optional workgroup networking capabilities. What's more, it can handle up to 13" x 19" paper sizes (perfect for those large documents, like the 1040 long form), and has a standard 650-sheet, two-drawer capacity. You can even upgrade by adding Adobe® PostScript® and duplex handling.

Likewise, it doesn't take an audit to see the PageWorks 12 is the most affordable laser printer in its class. Offering 12 ppm output and heavy duty cycles, it's powered by a 100MHz processor. It also has a standard 750-sheet capacity and optional networking capability.

PAGEWORKS 6L

PAGEWORKS 6e

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Smart Bombs/Nice Guns

Nonlethal-weapons researcher John Alexander left his Los Alamos National Laboratory post just two months after we profiled him in our February 1995 issue, but his ideas for an arsenal of weapons capable of shorting out communications systems, temporarily blinding enemy soldiers, or gluing foes in place with ultrasticky foams continue to gain acceptance at the United States military's highest levels.

To aid in the development of kinder, gentler armaments, the Department of Defense issued its first official policy statement on nonlethal weapons in July 1996. Signed by Deputy Secretary of Defense John White, the directive provides broad guidelines for when and where nonlethal weapons should be used. It also charges the US Marine Corps' commandant with coordination of nonlethal-weapons acquisitions for joint military programs.

Alexander, now a consultant to the office of the Secretary of Defense, cites Somalia as the watershed event that led to the DOD's new policy. Ostensibly sent on a humanitarian mission to feed starving Somalis, US and international troops instead found themselves caught in the country's civil war. Somali gunmen would fire on peacekeeping forces from behind crowds of women and children, a stratagem designed to deter return fire. When the multinational force pulled out in March 1995, General Anthony Zinni, then head of the withdrawal operation (now commander-in-chief of US Central Command), armed his troops with nonlethal weapons such as beanbag bullets, rubber-pellet grenades, and sticky foam. "Our experience in Somalia, and the support of General Zinni, proved to be a valuable impetus to the nonlethal program," says Don Henry, staff specialist at the Pentagon's Office of Munitions.

Many low tech nonlethal weapons are now readily available to the military and domestic law enforcement. The more advanced devices, however, such as electromagnetic pulse generators that can fry communications systems, are still in development. Studies are also under way on superslicks, substances that would render roads and airport runways too slippery to use but that could, according to Steve Scott, a technical research manager at Sandia National Laboratories, be rendered inert with the application of a second chemical. Scott's department developed the sticky foam and aqueous foam barriers (thick layers of suds laced with chemical irritants) deployed in Somalia.

John Alexander is now organizing a third international conference on nonlethal weapons development, scheduled for February 1998. Speakers at the previous two conferences have included novelist Tom Clancy and General John Sheehan, commander-in-chief of US Atlantic Command. Alexander's new book, *Future War: The Non-Lethal Factor*, will be published next year by St. Martin's Press. He notes that America's current military realities have to do not only with being prepared to fight an all-out war, but also with the need to conduct peacekeeping missions. "Nonlethal weapons are essential in this arena," says Alexander. "We now have more and more commanders who've been in very difficult situations, and for whom overwhelming lethal force was no help." – *Hal Stucker*

@Homecoming

In January 1996, Will Hearst of @Home Network told *Wired* its cable-delivered Internet service would be up and running in 1 million homes by early 1997. Well, up and running it is, but Hearst was just a little off in his numbers. As of summer 1997, @Home had only 7,000 US customers. But don't write them off just yet. @Home, whose IPO in July raised US$94.5 million, has forged alliances with seven top cable companies, whose wires snake past 44.3 million homes – i.e., potential customers – in North America. And the service, available in selected communities, *is* what was promised: a high-speed, affordable Internet provider (monthly costs range between $39.95 and $44.95). With 24-hour unlimited access, nearly instant connections, and speeds 10 times those of an ISDN line, @Home is dangerously close to making the Internet accessible – and attractive – to the masses. – *Rob Riddell*

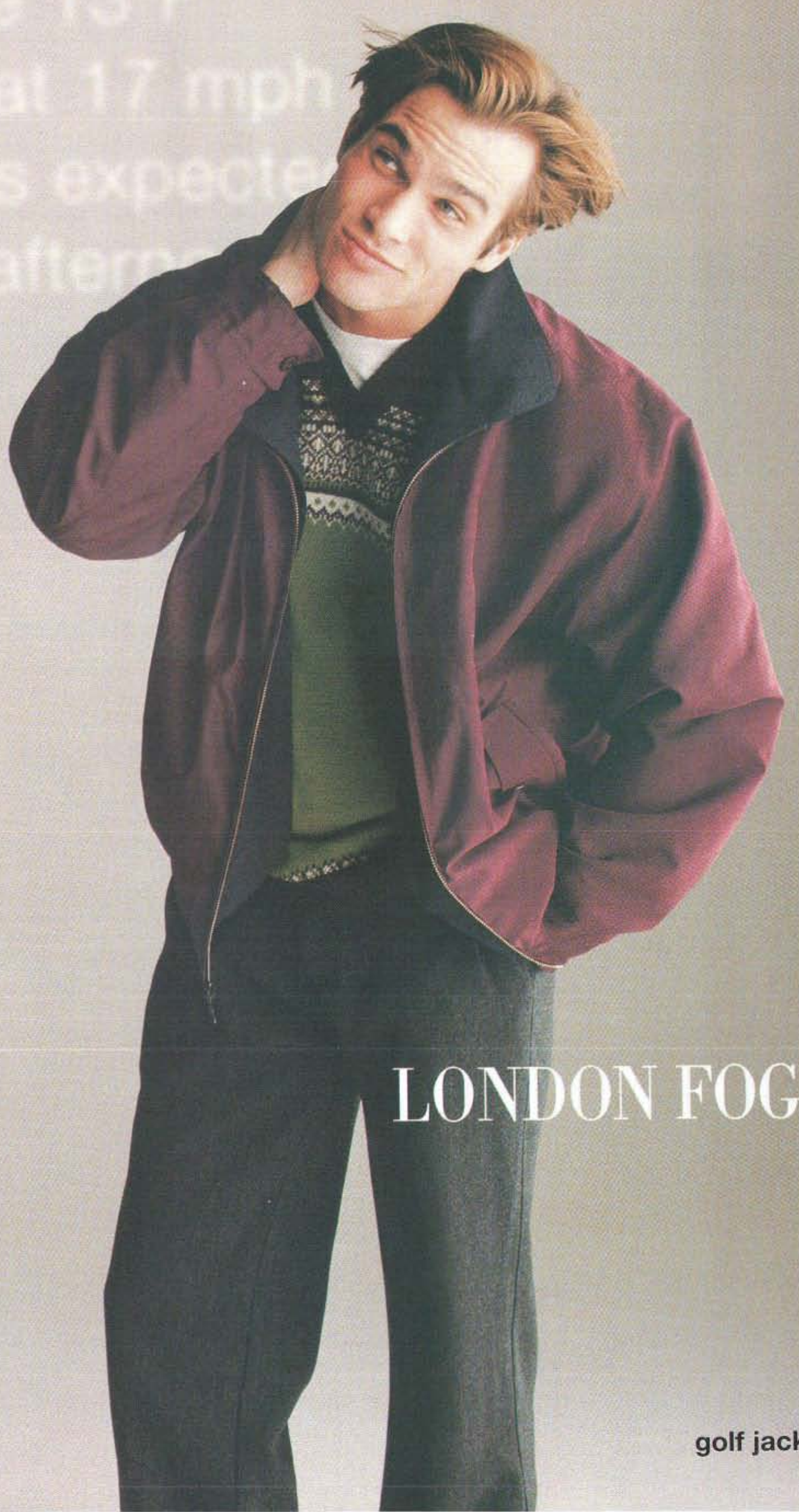
WIRED
Steven Brill and Court TV

You Be the Judge

We put Steve Brill, then CEO of Court TV, on our March 1995 cover, touting his network as the "law's interface to the public." Now, more than a year later, the cable channel is doing just that. For courtroom-drama junkies bored with the likes of the Timothy McVeigh trial's dull artist sketches and dry commentary, the network is rolling out BackChannel. This interactive option will give viewers a wealth of information – case files, bios on a trial's major players, explanations of legal terms – that they can obtain by clicking an icon on their TV screen.

One possible future option, says John Moran, Court TV's VP of broadband distribution, is for "qualified" viewers (those who have watched 75 percent or more of a trial) to play armchair lawyer, rating witnesses' effectiveness and predicting final verdicts. The buzzkill: the results wouldn't be released until the verdict is announced. Maybe someday we'll all be able to play judge, jury, and executioner from the comfort of our couches – and the next O. J. won't get away. – *Ted Roberts*

IMAGES: TOP LEFT: STEVE DOUBLE; TOP RIGHT: STEVE STARR/SABA; BOTTOM: NEIL SELKIRK



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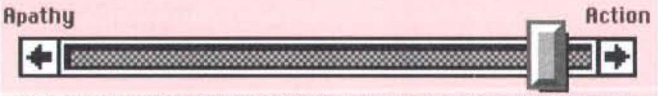
"Scotty, Beam Down the Lawyers!"

When free speech collides with trademark law.

By Jennifer Granick

If you've ever wondered what Chewbacca and Han Solo really did together, all those lonely nights aboard the *Millennium Falcon*, then fan fiction might be for you. From the ever-popular "slash lit" chronicling Captain Kirk's love affair with Mr. Spock to the secret diaries of Special Agent Dana Scully, fan fiction riffs on the characters and story lines that permeate our pop culture consciousness. Trouble is, fan fiction may be illegal.

Legally, fiction based on settings or characters from someone else's stories is considered "derivative work," which can't be published without permission from the original copyright holder. The distinctive "brand names" of Darth Vader and Captain Janeway, for example, are trademarks that can't be used in a way that diminishes the value of the mark, confuses people as to the true owner of the mark, or allows another to profit from the mark. Real-life celebrities – who may also be the subject of fan fiction – are similarly protected from unauthorized appropriation of their names or likenesses by a "right of publicity."



THE ONLINE FREEDOM FEDERATION has gone to red alert to protest Viacom's Internet crackdown. Join other *Star Trek* fans at the federation's petition and logo program: **www.off-hq.org/.**

VIACOM INC., owner of the *Star Trek* brand, can be contacted directly at **inbox@viacom.com.** The company has posted an official statement outlining its Internet policy at **www.paramount.com/openletter/.**

MISHA GLOUBERMAN has created a Web page to document the "trend toward the use and abuse of intellectual property law as a form of online censorship": **www.muchmusic.com/muchmusic/cyberfax/trademark.html.**

Intellectual property owners – and their lawyers – take infringement very seriously. Last year, Viacom Inc. sent a barrage of cease-and-desist letters to webmasters of *Star Trek* fan sites carrying copyrighted film clips, sounds, and insignias. Under threat of legal action, many Trekkers shut down, leaving behind scanned copies of letters sent by Viacom lawyers as memorials to sites that had once been ebullient celebrations of a favorite show. Then Paramount, a division of Viacom and owner of all things *Star Trek*, launched a company-sponsored Web site to promote the film *Star Trek: First Contact*.

The crackdown disillusioned fans and made ISPs nervous. Now, the uncertainty has infiltrated the frontiers of Usenet. When moderators reorganizing rec.arts.sf.starwars submitted their request for a subgroup dedicated to fan fiction, the gurus who have control of the Big Eight Usenet groups (comp., humanities, rec., misc., news., sci., soc., and talk.) vetoed the creation of a new group "where the traffic itself would be illegal." As one Usenet overlord explained, "Discussion of sex, guns, or illegal drugs is not illegal. Posting fan fiction is."

The Big Eight's self-censorship was prompted by worries that the *Star Wars* fan fiction group could become a legal liability for news hosts and ISPs. But without committing to any long-term policy, Marc Hedlund, director of Internet development for Lucasfilm, says the company tolerates the publication of fan fiction, so long as the stories are not for commercial gain and don't sully the "family" image of the *Star Wars* characters. Thus, authors of homoerotic Luke and Han stories may have something to worry about, but creating a *Star Wars* fan fiction newsgroup could be OK.

Meanwhile, Viacom did not respond to *Wired*'s requests for clarification of the company's *Star Trek* fan fiction policy.

Ultimately, however, the problem is not Viacom or Lucasfilm, but a legal system that says companies, and not the public, own cultural icons. In an age when Bill Graham Presents lays claim to "The Summer of Love," the public domain is being sucked dry by the intellectual property machinations of media giants. In the end, we shouldn't have to depend on the good graces of entertainment corporations for our freedom of expression.

It doesn't have to be this way. Expressive uses of familiar icons should be protected from intellectual property claims where commercial, for-profit uses are not. Trademark law should be narrowly interpreted to ensure that consumers aren't confused about which products they are buying, while still allowing cultural referents such as Spam, Luke Skywalker, and Mr. Potato Head to be cited freely.

By allowing free-speech principles to dominate the Neutral Zone that links pop culture and commerce, media titans will still make plenty of money, and our universe will be a more hospitable place for creative exploration. ■ ■ ■

Jennifer Granick (jgranick@dnai.com) *practices criminal law in San Francisco.*

Blocking the Blockers

Now that the Supreme Court has struck down the Communications Decency Act, the debate about filtering software – aka censorware – has taken on new urgency, leaving the nation's librarians caught in the crossfire between free-speech advocates and worried parents and teachers. In response, the American Library Association has decided to take a stand. In July, the ALA issued a resolution that strongly opposed blocking software, arguing that "the use in libraries of software filters which block constitutionally protected speech is inconsistent with the United States Constitution and federal law and may lead to legal exposure for the library and its governing authorities."

Wiretap Wars

The long battle over implementing the wiretap provisions of the 1994 Communications Assistance for Law Enforcement Act (CALEA) continues. Frustrated by law enforcement's attempts to significantly expand its snooping capabilities, the Cellular Telecommunications Industry Association (CTIA) has petitioned the Federal Communications Commission to resolve the deadlock between the FBI and the industry over technical standards for electronic surveillance. The problem, the CTIA noted in a July 15 letter sent to FBI director Louis Freeh, is that the standards process has been "delayed time and again by law enforcement efforts to interpret CALEA as the floor, not the ceiling, in electronic surveillance." In response to the CTIA letter, Attorney General Janet Reno has indicated that she is eager to continue discussions on the wiretap specs. In the meantime, the trade group plans to pursue its petition with the FCC.

ILLUSTRATION: NICK PHILIP

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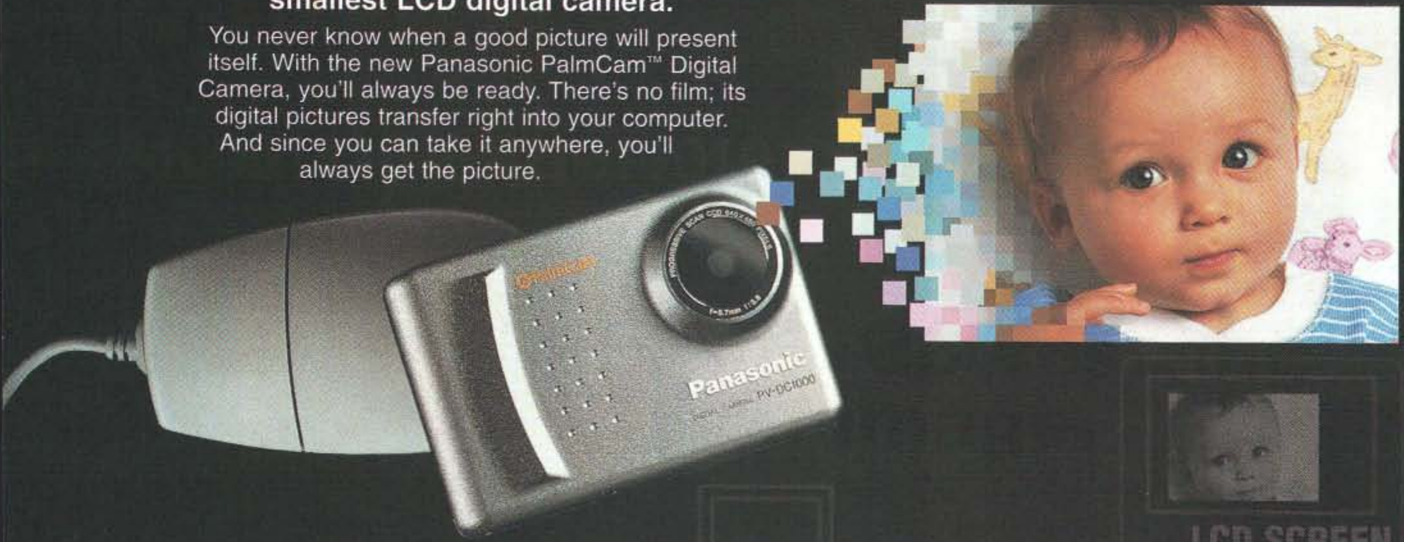

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OCTOBER 1997

A WHERE-TO-GO, WHAT-TO-BRING, HOW-TO-GET-THERE GUIDE

WIRED TRAVEL

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People like GeoCities. People like Michele Madansky, who likes GeoCities not only because it's home to her outrageous guide, *East Village Dining, Drinking & Carousing* (www.geocities.com/napavalley/2788), but also because GeoCities makes her job as BBDO New York's resident Interactive Goddess (a.k.a. New Media Manager) much easier.

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* PC Meter, May '97

**Neilsen's I/PRO, June '97

WIRED TRAVEL

The instantaneous communications of the digital age allow us to be *anywhere* physically and still be *somewhere* virtually. We're no longer controlled by place or distance.

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Consider this your where-to-go, what-to-bring, how-to-get-there guide to plugging in *and* unplugging around the world.

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WIRED MECCAS

A robot kingdom at the foot of Mount Fuji, a 21st-century capital built on the ruins of the Berlin Wall, a pulsing media center outside of New York, and the frenetic urban landscape of China's Pearl River Delta – these are places to see the future erupting.

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AGRESSIVO

The country of Pelé and the samba has become a global television powerhouse. Patrick Symmes explores the lush media landscape of Brazil.

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UNWIRED MECCAS

The antidote for digital saturation. Explore the vast open spaces of the Rajasthani desert or an isolated island village in the southeastern Aegean.

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HACKING CITIES

This guide to five top business destinations is crammed with all the hows, whats, and wheres you need to know about Tokyo, London, Milan, Sydney, and Hong Kong.

s22
GEEK GEAR

What does a hacker tourist pack? Here's an illustrated cheat sheet.

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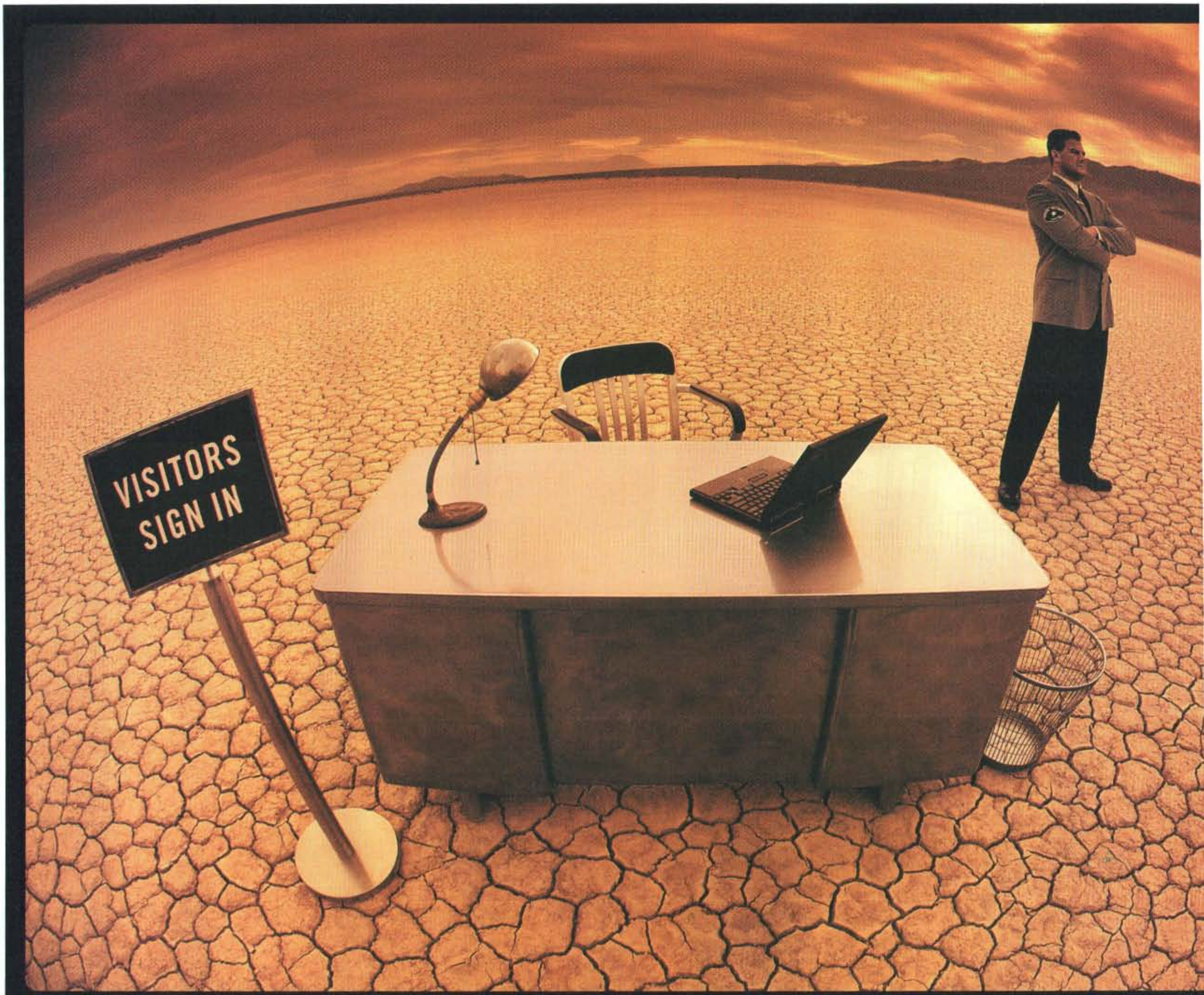
COVER IMAGE: ORIGINAL PHOTO BY WILL & DENI MCINTYRE/PHOTO RESEARCHERS; VIDEO MANIPULATION BY DANIEL CARTER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IT IS A SCIENTIFIC FACT that people are nosy and the thing they want to see the most is probably the thing you least want them to see. This explains why the Web is chock-full of stuff that is so unimportant, it doesn't matter if everybody can see it. Stuff like UFO chat lines, recipes for zucchini bread and short stories that nobody would publish on real paper. True, there is some business stuff. But it's mostly "brochureware" – general information aimed at the broadest audience, and therefore not terribly critical to anyone.

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WIRED MECCAS

THESE THRIVING GLOBAL CENTERS ARE DESTINATIONS FOR THE WIRED TOURIST, PLACES TO WATCH THE FUTURE ERUPTING NOW.

POTSDAMER PLATZ

BERLIN, GERMANY

The Berlin Wall once snaked through the city, a symbol of divided Germany. Now the Berlin of tomorrow is rising in its place. This is Potsdamer Platz, the site of more than 300 major construction projects, scheduled to be finished in 2002. The 150-acre area, smack in the middle of Berlin, is a potential urban nightmare. Recognizing this, the site's primary investors – Sony and Daimler-Benz – devised some deflective PR, turning blueprints into architainment.

Thousands of tourists have been lured by the spectacles of engineering. Some seem to rival acts of God, like the digging of a temporary riverbed for the Spree River while a car and train tunnel is excavated below – all without interrupting ship traffic on the waterway.

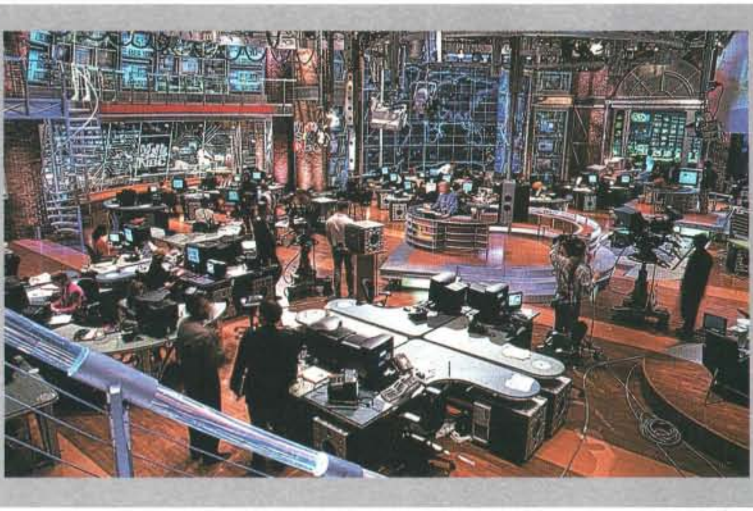
Many of the engineering stunts have a digital twin, made possible by the magic of the Info-Box. Inside this bright red, three-story building in the Platz, computer models demonstrate, for example, how huge amounts of soil were removed from the site. Or how the soaring European headquarters of Sony and the new musical theater and cine-center will look when

MSNBC CENTER

SECAUCUS, NEW JERSEY

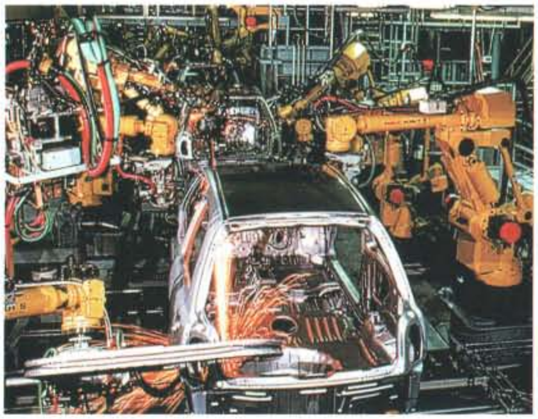
Across the Hudson River from New York City, rising out of the New Jersey wetlands, sits the digital nerve center of MSNBC, the joint venture between Microsoft and broadcasting's old guard. This former industrial warehouse pumps out news 24 hours a day for the MSNBC cable channel and Web site, reinventing the technology of newscasting in the process.

A dozen steps beyond the gleaming lobby lies the main studio, an 18,000-square-foot space with 24-foot ceilings, wood floors, and exposed brick walls. A circular anchor desk occupies the center of the room, surrounded by dozens of workstations. Overhead, computer-controlled lights swivel at the end of hydraulic arms, and a remote camera skates a steel monorail track around the room's perimeter. Off to one side, a monitor



FANUC HEADQUARTERS

OSHINO-MURA, JAPAN



It is easy to understand how Mount Fuji became famous and sacred. Its size and symmetry dominate the landscape and mind. But today, at the mountain's foot, a huge, glaring yellow complex of buildings competes for attention. This is Fanuc, one of the largest and most modern manufacturers of industrial robots, with more than 70 facilities worldwide. The Mount Fuji complex produces machine-tool control devices, pulse motors, and robots for use in factories such as Nissan's Kyushu auto plant (at left).

Robot Factory F has an eerie, futuristic air to it. Here, robots and parts for robots are manufactured – by other robots. On a spotlessly clean floor the size of two football fields, the 60 human workers look like ants, lost among robots, computerized machine tools, and automatic guided vehicles. At night, the human workers disappear from the floor, and manual assembly and testing operations

PHOTO OF INFO-BOX: DPA/IPOL, INC.;
POTSDAMER PLATZ: BRUNO BAKALOVICH

TIRED	WIRED	TIRED	WIRED
747 exit-row seats	777 ergonomic seats	Melatonin	Scotch
Rand McNally	Maps On Us	SAS	Virgin Atlantic
Narita Airport	Atlanta International Airport	Walkman	Walking Man *(www.walkingman.com/)*
Flight-sim landing	Hong Kong landing	Host Marriott	Encounter at LA International Airport
Fodor's	*Travels with a Laptop*	AC outlets	K.I.S.S. solar panels

they are finished. Visitors can take a virtual ride on the yet-to-be-built Transrapid magnetic levitation train. The Info-Box adds another layer to the architainment phenomenon – it offers an ongoing lesson in How to Hack a City, from the foundation up. – *Boris Gröndahl*

Contact art:berlin for tour information: +49 (30) 215 9868, fax +49 (30) 215 3089.

bank tracks the satellite feeds streaming in from around the globe.

Caffeine-buzzed twentysomethings skim in and out, rushing from the studio to editing rooms to control rooms in a frenzy of production. One year after its launch, MSNBC's cable channel reaches 37 million US households, while the Web site generates almost two million pageviews a day. But it is the routers and PCs and untold miles of cables that make this swampland news center a media power point of the next century. – *Rich Santalesa*

For more information contact: +1 (201) 583 5000, on the Web at *www.msnbc.com/*.

cease, leaving the machines to continue automatically. The lights are dimmed. Machines, unlike humans, need little rest, and they work fine in the dark. - *Frederik L. Schodt.*

An updated excerpt from Inside the Robot Kingdom *(Kodansha International).*

To get to Fanuc, take a bus from the Shinjuku Station in Tokyo to the Hotel Mount Fuji in Oshino-mura. The two-hour ride costs about ¥2,000 (US$17). From the hotel, take a taxi to the factory. For tour information contact Mr. Tomita: +81 (5) 5584 5555, fax +81 (5) 5584 5512.

PHOTO ABOVE LEFT: MARCELA CORTINA;
PHOTOS ABOVE RIGHT: JUN TAKAHASHI

PEARL RIVER DELTA CHINA

The Pearl River Delta, in southeastern China, is the bastard child of Hong Kong and the mainland. Twenty years ago, the Guangdong province was filled with sleepy farm towns and rice fields. Now the region offers a jaw-dropping view into 21st-century China; it is a thriving industrial center that proves profits are stronger than ideology.

This maniacal development was sparked by the creation of Special Economic Zones in Shenzhen and Zhuhai. In 1979, those cities were opened to foreign investment and manufacturing. Now more than 80,000 Hong Kong-related companies operate factories in the delta, and, in 1996, US$2.5 billion in foreign funds poured into Guangdong.

Though fueled by industry, the explosion of the Pearl River Delta is more than a story of economic growth. It is a tale of the city, a study in urban planning (or lack thereof), and a model of Asia's chaotic local growth and escalating global power. The flat, communal farmlands – stretching from the Kowloon peninsula to Guangzhou (previously known as Canton) – are interrupted by shiny new glass skyscrapers, and decrepit shantytowns lie next to modern city blocks. A new boomtown seems to spring up every few weeks; seven airports and twice as many major harbors now occupy the 29,000-square mile region. The population tops 26 million and is expected to reach 34 million by 2020.

This "maelstrom of modernization is destroying, everywhere, existing Asian conditions and creating, everywhere, completely new urban substance," asserts Rem Koolhaas, the Dutch architect who has been involved in the region's development. Koolhaas's explanation of the growth of the Pearl River Delta would have left Frank Lloyd Wright dumbfounded. The "Bastard Metropolis" eschews the control and perfection of planned cities, he says. Urban centers, he notes, seem to have been "Photoshopped" onto the landscape.

Visitors may wonder if they're witnessing the birth of an industrial region, the rise of a superpower, or the rebirth of the city. The Pearl River Delta reflects all three at once. – *Jessie Scanlon*

Southeast China Airlines offers regular flights to Shenzhen and Guangzhou from Beijing and other major Asian cities. Shenzhen is a 50-minute train ride from Kowloon. Once in the Pearl River Delta, travel by train or bus. Chinese Tourist Office: +1 (212) 760 8218.

BITS + BYTES

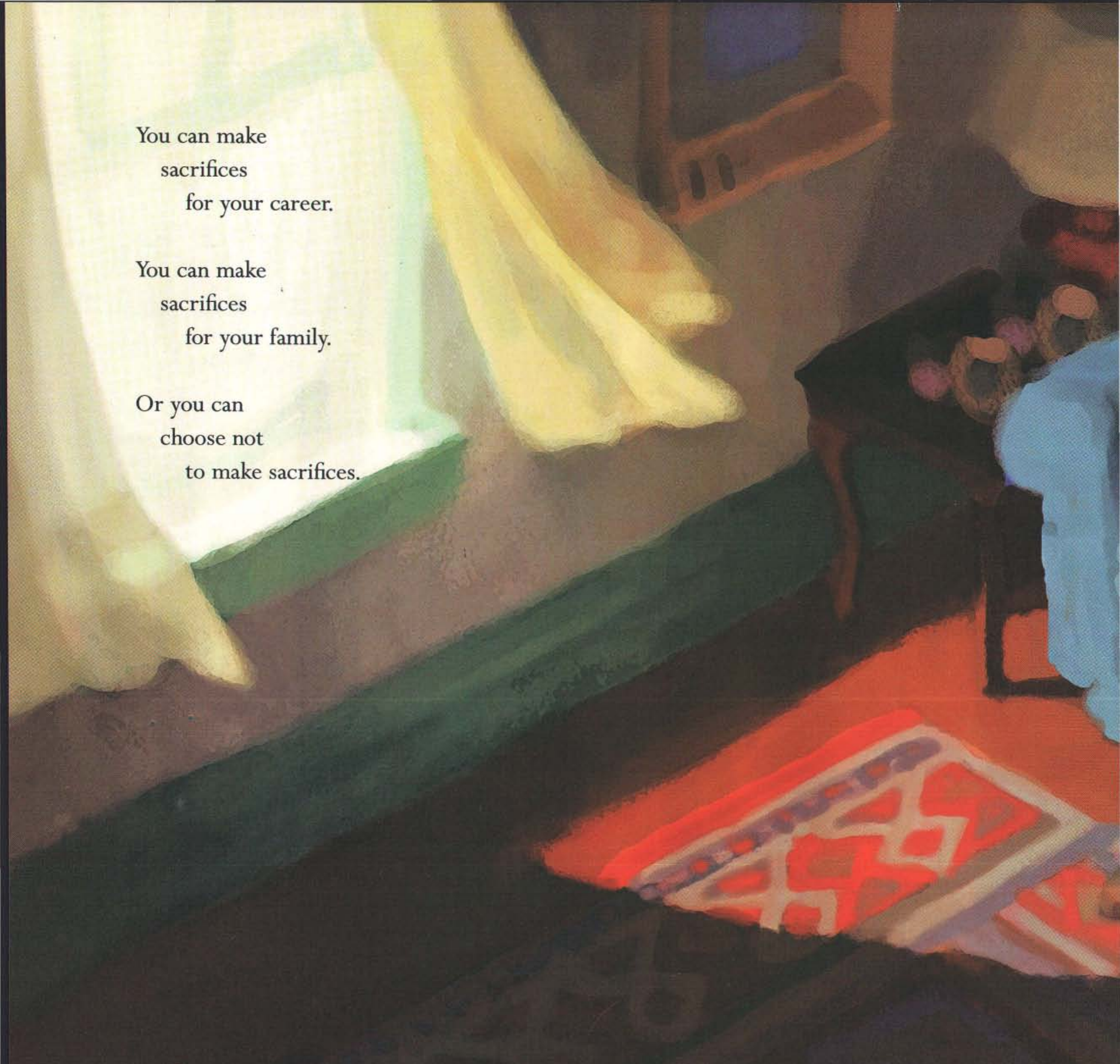
TIPS ON WIRED TRAVEL

Culled from *Wired*'s frequent fliers, techie professors, foreign correspondents, and other roaming hackers.

Printer Me This: A fax modem is the lightest portable printer around. Send a fax to the hotel, marked to your attention. But get the fax facts first – some hotels charge up to US$3 a page for the "service."

A la modem: You can leave the manual at home, but the AT commands are a travel essential. This string of geeky gibberish – usually listed in the owner's manual or stored in the modem's temporary memory – tells your modem to wait (or rather, *not* to wait) for a familiar dial tone or to connect at a different speed.

Negroponte's Law of Wired Travel: Log on with a local call. Choose a global ISP or a consortium like Global Reach with POPs in multiple regions. (Get local access numbers in foreign cities before you depart.) Or try Hotmail, a free service that forwards email to a Web page accessible from any Web-browsing machine (*www.hotmail.com/*).



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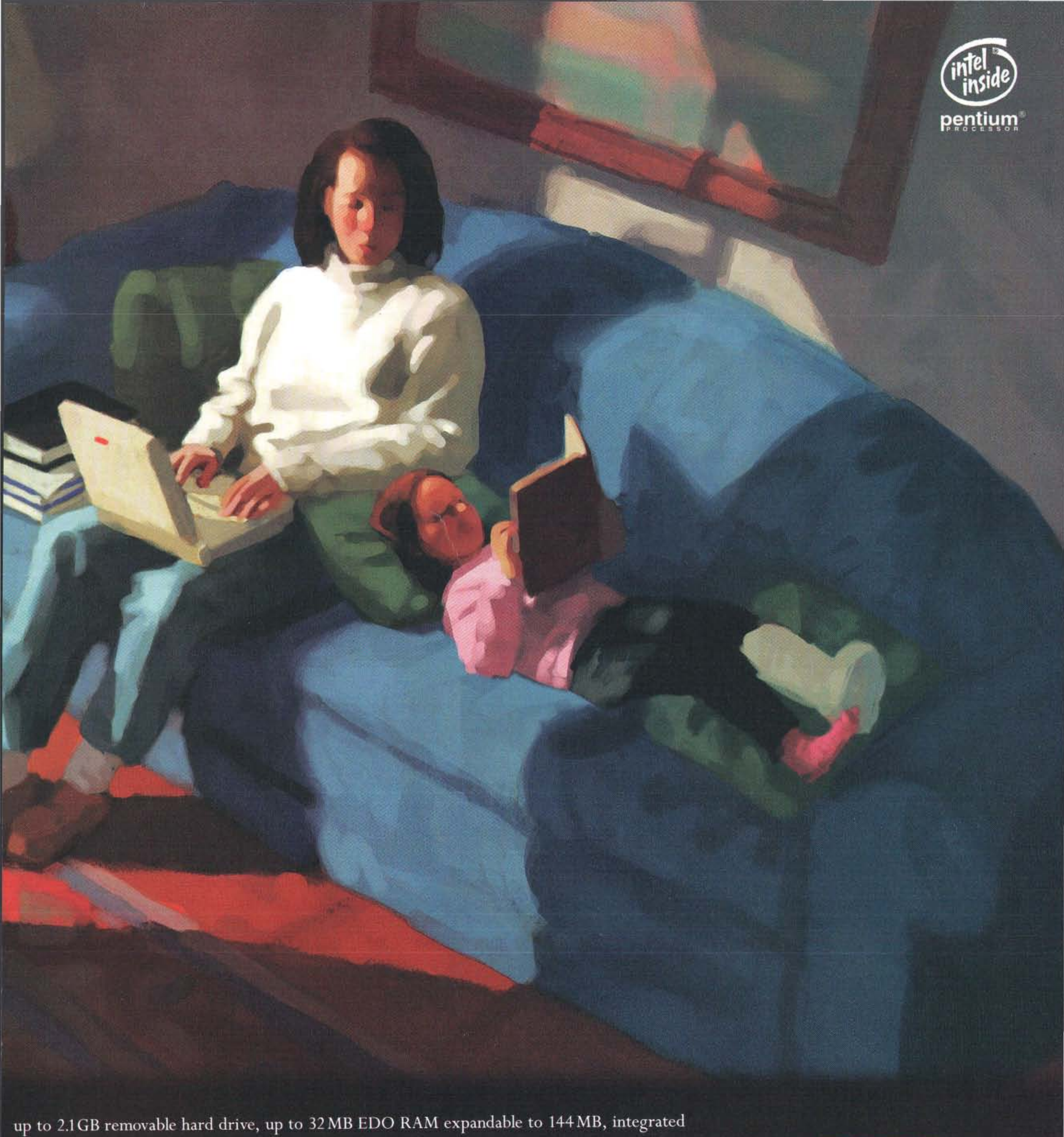

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AGGRESSIVO

BITS + BYTES

④ **Foreign Telcos:** The robber barons of the global village; if you have to dial long distance, use an international calling card or – even better – a corporate 800 number. Even then, watch out for usurious hotel charges.

⑤ **Getting the PowerPoint:** Your presentation isn't presentable when it's time to hit the road, and the file would take nearly an hour to download later at 28.8 Kbps. But if your work team uploads the finished file to your company's Web server, you can give the presentation straight from the site.

⑥ **Rotary Dial:** When using an acoustic coupler hookup in Eastern Europe or any country that uses older rotary telephone equipment, you'll get a better Net connection if you bang the receiver on a table a few times to loosen any lumps of carbon grain.

⑦ **Airport Reality Check:** X-ray machines are harmless, but never walk through a metal detector with a laptop or magnetic data.

THE HACKER TOURIST MAPS BRAZIL - A THRIVING MEDIA POWERHOUSE BUILT ON SOAPS AND SAVVY.

BY PATRICK SYMMES

Lorenzo Lamas has been following me across Latin America for years. Wherever I go - from Havana to Patagonia - the star of the B-grade series *Renegade* is sure to show up, riding his Harley-Davidson across the TV screens of Peruvian bars, Argentine hotels, and Bolivian huts. Likewise, I've watched *Lois & Clark* in a remote Chilean fishing village, and have seen one of the world's great miracles: David Hasselhoff speaking fluent Spanish. Wherever I've traveled in Latin America - in the world, for that matter - US TV was always close behind. Until I reached Brazil.

In the rising tide of a blue jeans-and-burgers global monoculture, Brazil is a land that refuses to go under. Instead, it bobs on the waves of foreign influence: The Rio de Janeiro music scene is heavily influenced by rock, jazz, rap, and reggae; cinemas show Hollywood movies; and *Candomble*, a popular religion, blends Catholicism with African spiritualism. But all cultural imports seem to pass through a filter that reframes them, producing in the end something utterly Brazilian.

Encompassing half of the land and population of South America, Brazil is an economic and cultural powerhouse, set apart from its neighbors by language, custom, and a vibrant mixture of African, European, indigenous, and, more recently, Asian bloodlines. Divided by broad stretches of wilderness and immense belts of poverty, eclectic in religion, regional dialect, and race, Brazil is united by only two things: soccer and television.

The country consumes and produces the latter commodity in staggering quantities: It is a nation of 35 million television sets and 100 million viewers watching an average of seven hours a day, a country where illiteracy is widespread and twice as many people own televisions than own telephones. TV, understandably, is a powerful, centralizing institution that delivers the national voice of Brazil.

And the influence of Brazilian television doesn't stop at the nation's border: 130 nations consume Brazilian programming, making Xuxa - the lip-synching queen of Saturday television - a star around the world. Hundreds of millions of Chinese watch Brazilian shows (dubbed into three dialects), Nicaraguans are obsessed, Scandinavians are hooked, and even Lech Walesa and Fidel Castro are fans.

This flies in the face of conventional wisdom, which assumes that the most developed nations control knowledge-intensive industries like communications and entertainment, while the rest of the world does the manual labor: assembling electronics, stitching sneakers, and growing tomatoes. As one pundit in Washington told me with unconcealed nationalism, "We may not make the VCRs any more, but we still make what goes into the VCRs."

So much for conventional wisdom. Brazil is a poster child for the new global economy: a decentralized, dynamic, multidirectional marketplace in which anyone can play. With the eighth-largest economy in the world, not only does Brazil manufacture such sophisticated products as automobiles, airplanes, and computers, but the South American giant has become a global media powerhouse - a feat few non-Western countries have managed. The vast majority of its television programming is made locally. And watched globally.

As I sat in my hotel room in Rio, remote in hand, I had to wonder about the appeal of this low-budget, low-concept TV. Just how did the Brazilians trump Hollywood and the multinational media cabal?

THE SOAP FACTORY

It all began with the humble soap opera. Like most things nefarious in Latin America, the rise of the Brazilian soap, or *novela*, can be traced to Fidel Castro. In the 1930s, Cuba developed an industry in writing, performing, and exporting radio novelas. Soaps were such a lucrative industry that when Castro's army stormed Havana on January 1, 1959, many writers fled.

A TV NATION: **The largest country in South America, Brazil covers 3,300,171 square miles. From the Amazon basin in the north to the cosmopolitan centers of the southeast, the lush media landscape is dominated by telenovelas such as *Zazá* (top left), *The King of Cattle* (top right), *The Untamed* (middle row and bottom right), and *War of the Sexes* (bottom left).**

BACKGROUND PHOTO: ORIGINAL IMAGE BY WILL & DENI MCINTYRE/PHOTO RESEARCHERS

⑧ **On Recharging Your Laptop:** In the airport, think like a janitor – carpets need vacuum cleaners, which need power outlets. And those golf cart-like service vehicles are electric – if you pass one sitting unattended in a corridor, it's probably recharging in a wall outlet. On the airplane, look for outlets in the vestibule areas (again, the Carpet Law) but don't count on the bathroom shaver plug, which often shuts off after five minutes. United, Delta, and other major airlines are starting to provide in-seat power outlets in first and business class. In rental cars, use a 10- to15-volt converter to plug into the cigarette lighter.

⑨ **Negroponte's Law of Recharging:** In a hotel room, use the outlets designated for the bathroom shaver, the fax, or the electric clock – these outlets usually aren't connected to a master switch (which the maid is instructed to flip off).

⑩ **Plugs of Last Resort:** Where there's a fax machine, there's an RJ-11 jack. Also, hotels tend to frown on 5 o'clock shadow, which means most rooms anywhere in the world have a standard US outlet for electric razors. And if you're adaptorless in Asia, you can cut off the third prong and fit it into a two-prong outlet – it should work. ►

The first "Brazilian" soaps were written in Argentina by Cuban exiles.

Today, Brazilian soaps are virtually synonymous with Rede Globo. The media giant produces 4,420 hours of original programming a year - including news, novelas, sports, music, and children's shows - more than any other network or studio anywhere, the company claims. Globo's primetime soaps run six nights a week, routinely garnering a 75 percent audience share, and the network's 105 stations earn 2.1 billion Brazilian real (US$1.9 billion) annually. Measured by audience, Globo is the fourth-largest network in the world after ABC, CBS, and NBC.

Rede Globo's parent company, Globopar, employs some 23,000 people in businesses ranging from *O Globo*, the nation's largest daily newspaper, to books, magazines, real estate, construction, insurance, and banking. But no Globopar business reflects the scale and influence of the company more than its soaps: *Malhaçao*, *Love Is in the Air*, *The Untamed*, and *Zazá*. These series are produced at a new BrR324 million (US$300 million) facility set in the lush grasslands outside of Rio.

A self-contained 1.3-million-square-meter complex, the Global Production Center could sit out a nuclear war quietly churning out episodes of *Love is in the Air* for the survivors. The soap factory resembles nothing so much as the villain's lair in *Thunderball*. The walled-off complex is staffed by 2,500 employees, most of them wearing various uniforms in Globo Blue, the company's official color. Globo is vertically integrated, which is another way of saying the company likes to have its own toys: The production center has a 5,000-kilowatt power plant, a helipad, an explosives bunker, a bus system, and machine and model shops. Globo employees buy Globo magazines at the Globo newsstand, and eat Globo food in the Globo restaurant (with low-fat selections for actors). To make Globo soaps appealing to everyone in this diverse country, Globo actors are even coached to eliminate regionalisms from their accents - they call it "Globotalk".

Most of this I learn from Antonio Nascimento, an earnest Globo junior exec who briefs me with a pointer and map before grabbing the keys to our golf cart (complete with Globo license plate) for a three-hour tour. We roll silently southeast through the complex until - 20 minutes and a thousand miles later - we come to a stop in the town square of Greenville. A Potemkin village of flimsy facades and streets leading nowhere, Greenville is the setting of *The Untamed*. All the details are right, down to the carefully faded Metallica poster on a kiosk.

"Quality," Antonio says, knocking on a stone movie theater's wooden facade. This is his explanation to my nagging question: What is the secret of Brazil's television success?

Quality? I ponder this answer at our next stop, an airplane hanger on the set of *Zazá*. The night before I'd watched the villain - a Marlon Brando lookalike minus most of the weight and all of the talent - as he schemed to kidnap the heroine's love child. There were clumsy special effects and embarrassing horror-movie music. This was quality?

Night after night the evidence poured in, until I could no longer deny the obvious: Brazilian TV wouldn't win any Emmys. To be sure, Globo is raising its sights: a new, US-style police drama, for example, is being shot on film rather than video. But most programming occupies a dusky niche between US daytime and nighttime fare, better than *General Hospital* but nowhere near the standards of pacesetters like *ER*.

O TEATRO POPULAR

If it isn't quality that explains Brazil's media dominance, then what? Before I'd left for Rio, some Brazilians in the US had enlightened me on the profound social significance of the novela.

One of the country's most famous soaps, *Roque Santeiro*, was banned in the '60s and '70s for its subversive parody of the nation's social system. When the show ran in 1985, one episode received a 98 percent rating - virtually every TV in the country tuned in. Dias Gomes, the program's author, is Brazil's elder statesman of soap writers. A slight man with a shock of gray hair, he sits across from me in his spacious beachfront apartment in Ipanema, analyzing the Brazilian novela. It is a sort of people's theater, he explains, in which social aspirations are "integrated into our daily reality." The majority of people don't read much, the theater is elitist, and the domestic film industry has buckled under pressure from Hollywood. "We had to have some form of popular expression," he says. "With an audience of 50 million, television is a medium of expression for the masses."

Globo takes this idea seriously,

> **"QUALITY," ANTONIO SAYS, KNOCKING ON A STONE MOVIE THEATER'S WOODEN FACADE. THIS IS HIS EXPLANATION TO MY NAGGING QUESTION: WHAT IS THE SECRET OF BRAZIL'S TELEVISION SUCCESS?**

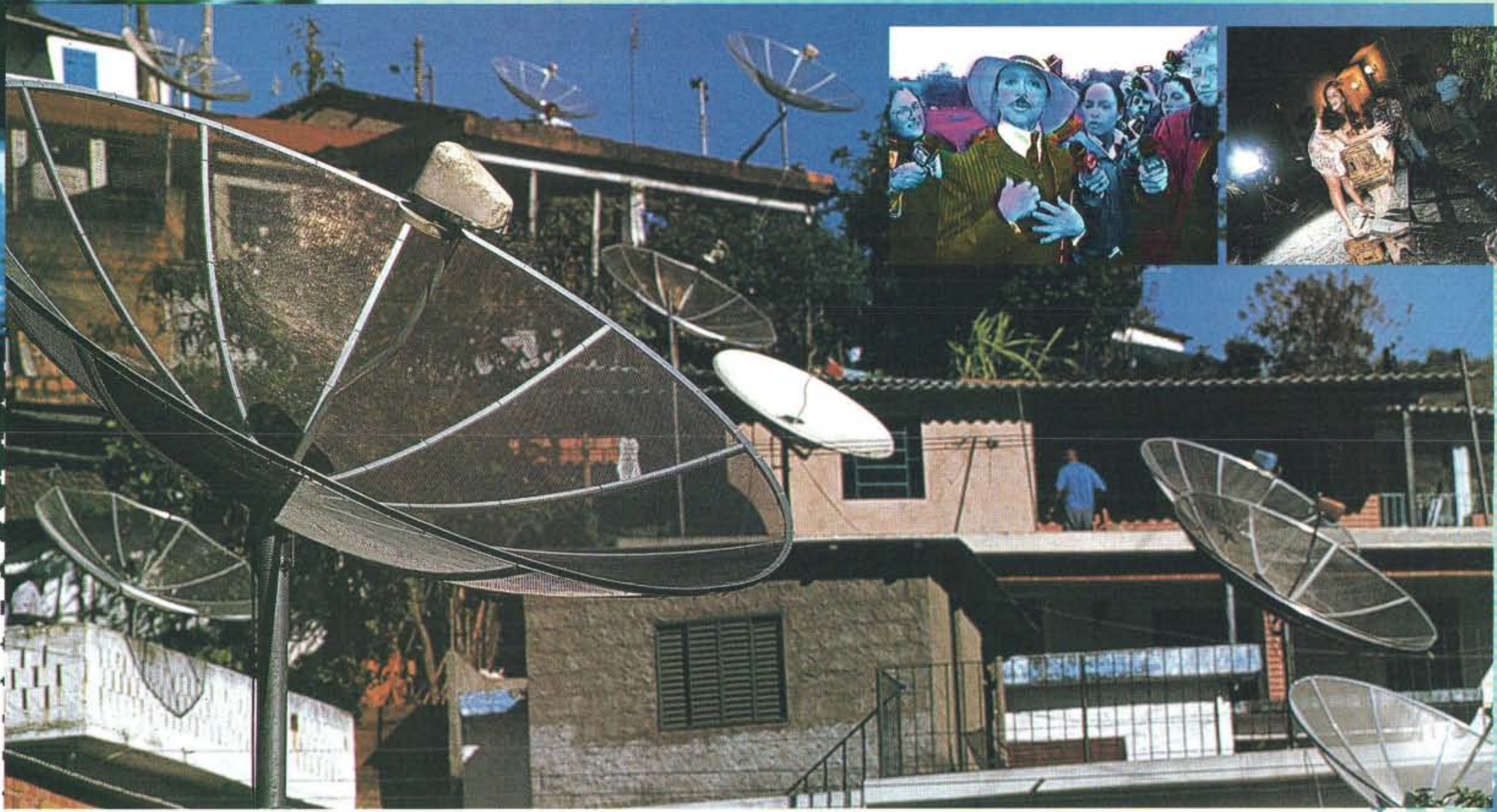
BITS + BYTES

⑪ **Mind Your Modem:** **Don't skimp on this telecom essential. A high-quality modem should detect digital networks, connect despite line noise, and have a built-in impulse tax filter.**

⑫ **Mind Your Manners:** **In China, never write a note in red ink and avoid using the number four – both are symbols of death. In South Korea, don't scribble a note on someone's business card. These and more dos and don'ts are explained in *Business Etiquette in Asia – An Overview*. For a free copy, email *apulse@geko.net.au*.**

⑬ **Rental Car-diac Arrest:** **Your flight landed late, your meeting starts in 20 minutes – somewhere in the middle of downtown – and you're having a Budget crisis. Next time, rent a Hertz – the Neverlost car has a built-in GPS navigational system. Available in the US only. For more information, contact Hertz: (800) 654 3131, on the Web at *www.hertz.com/*.**

⑭ **Hotel Hell:** **Many bigger hotels have duplex phone systems that make it impossible to get a direct outside dialtone. To get online, ask the hotel operator to place the call to your service provider, immediately drop the handset, and start up the modem.**



and actively embeds social messages in its plots. One recent soap, *O Rei do Gado (The King of Cattle)*, addressed the issue of land ownership. Another, *Salsa e Meringue*, questioned standards of beauty in a multiracial country by pitting a dark-skinned woman against a light-skinned woman in a love triangle.

But the idea of the novela as a catalyst for social reform simply didn't jibe with what I was seeing. I rattle off my nightly viewing menu to Gomes, a catalog of stories about rich white people and love affairs, private jets and formal parties. Where are the masses? What is the redeeming social value?

"*Azar*," Gomes mutters, using the expression Brazilians exclaim when the ball just misses the net. "*Azar*, you came during a bad week."

ESCAPING RIO

I stumble upon another answer on a shuttle flight from Rio to São Paulo. As I'm taking my seat, I recognize the ruggedly handsome man sitting next to me as Paulo Gorgulho, one of the stars of *Zazá*. I've been watching him all week as he fought off the advances of a nymphomaniac virgin; how can viewers in the *favelas*, the hillside slums of Rio, stomach the absurd unrealism of this stuff? How, I ask him, does Brazilian television manage to speak to so many people? What's the appeal?

"You must understand that the *favelado* knows the novela is a lie, he knows it is false," Gorgulho explains. *Of course* the stories are not realistic, Gorgulho says; the villains are very, very bad, the heroes are very, very good, and the plot ends neatly after six months. Life for Brazil's poor, disenfranchised masses is far more difficult - which is precisely why they relish the success and excess of these fictional characters.

It's a tried-and-true formula that's been around since Shakespeare, Gorgulho notes. The Bard's great plays are filled with romantic triangles, clashing dynasties, troubled marriages, action, comedy, and violence. And the way Paulo describes *Zazá*, gesticulating passionately over his tray table, it sounds like a modern-day *Romeo and Juliet* - with a Brazilian twist, of course. Both offer the same thing: catharsis, and a kind of emotional escapism. With so many people condemned to life without hope, the novela is a chance to fantasize, to enjoy the success of others, to see the lives they will never lead.

Satellite dishes in the slum of Teresópolis, 60 miles from Rio. Here, life's essentials include food, shelter, and good television reception.

In a recent episode of *Zazá*, the novela's namesake and star talks to reporters (left inset). The camera rolls on the set of *The Untamed*, at Globo's soap factory (right inset).

PHOTOS OF SATELLITE DISHES & SET: RICARDO FUNARI/IMPACT VISUALS

FARE PLAY

A SITE THAT'S OUTTA SITE

TravelBids (*www.travelbids.com/*) represents something rare in the travel industry: an efficient market. The "reverse auction" Web site lets travel agents compete against each other to offer the best deal, sacrificing some of their commission to offer the greatest discount.

While other travel auction sites ask people to bid for a predetermined trip, TravelBids users set their own itinerary, make the reservation, and then post the ticket info on the site.

The bidding begins, as travel agents – the site has attracted around 50 regulars – try to offer the lowest price and win the sale. Users are guaranteed at least a 6 percent discount, and most get more.

Travelers and agents pay US$5 to join and $5 to post, but skeptics can watch the bidding-in-progress for free. The site logged around 500 transactions in its first six months, and membership is growing.

The efficient market of TravelBids may well revolutionize more than travel. "The reverse auction model would work for automobiles or any other widget," says company president Hal Segal, an industry veteran. But for the moment, TravelBids is the ticket to tickets. – *Jennifer Sullivan*

GLOBO-LIZATION

Gorgulho's theory explains why the soaps strike such a chord around the world – people everywhere want to escape. But another possibility lingers in the background: Globo's not-high-quality, occasionally socially relevant, multicultural soaps are backed by a world-class marketing machine. The principle is the same at home or abroad: Give viewers what they want. Where price is the issue, Globo sells programming cheaper than syndicated competition from the US. Where quality is the issue, Globo sells soaps that are markedly better than those produced by Mexico, Latin America's *other* novela exporter. And where social standards are the issue, as in the Middle East and Singapore, Globo provides a mild alternative to violent, racy US fare.

One man has been behind much of this strategy: Roberto Marinho, the legendary owner of Globo. Born at the cusp of the century, Marinho took control of his father's daily newspaper in 1925, forged a critical alliance with the military regime that came to power in 1964, and moved into television the next year. The dictatorship provided Marinho with station licenses and other support, and he provided it with a tool for uniting and controlling the nation.

For a while, at least. Marinho turned against the dictatorship in the 1970s, and supported the return to democracy in 1984. He became a king-maker among citizens, helping elect the conservative Fernando Collor de Mello president in 1990 by slanting the network's coverage, and then breaking Collor two years later when the politician turned out to be corrupt.

My requests to interview Marinho were ignored, and one Globo official told me – before tossing me back onto the street in a most polite and discrete manner – that at age 92 the man was no longer transmitting on all channels. Though day-to-day control of the private company has passed to his three sons, they have their father to thank for putting Brazil on the international media map.

None of the world's big media players blocked Brazil's entrance into the market because no one wanted to sell what it was selling. And selling well. Globo had perfected its product, boiling it down to the essential dramatic elements, stories that appeal to viewers of all cultures, classes, and societies. The cultural melting pot of Brazil proved to be the best possible preparation for the international marketplace.

Now the next generation of Marinhos is taking Globo to bigger budgets and playing fields. Roberto Irineu, João Roberto, and José Roberto – all in their 40s and all company vice presidents – have accepted that Globo will lose its near monopoly on Brazilian media as multinationals move in, and are counterattacking by going global: Globo has courted deals with AT&T for cellular phones, Ted Turner for cable, and Rupert Murdoch's NewsCorp for satellite television. It also plans to launch dozens of magazines, start five channels across Latin America, open theme parks, and sell "off-the-shelf" TV operations to less-developed countries. Globo predicts a gross income of BrR5.4 billion (US$5 billion) by 2000.

Meanwhile, Globo's success has already inspired others. The country's upstart television networks, based mostly in São Paulo, knew they could get nowhere competing against Globo's established sports, news, and novelas. So they created a new kind of program known as news *agressivo*, a mixture of violence and social advocacy that resembles a guerrilla campaign fought over the airwaves. The first such program, *Aqui Agora*, launched in 1991. Six years later, these "real life" shows have become programming staples, by appealing to the same millions of viewers who bought into Globo's dramas. Where soaps are pure flights of fantasy, agressivo shows are an optimistic take on a grim reality. If novelas offer escapism, agressivo offers the promise that escape is possible, that hardships can be overcome.

BE AGGRESSIVE

Dawn is not a bad time to set eyes on São Paulo – at least not as bad as other times of day. Largely flat and featureless, it is the world's third-largest city, a gritty urban nightmare to Rio's sunny daydream. With 22 million people, SP is the engine of the Brazilian economy, a bustling city that would stretch to the horizon if you could see that far; the pollution is so bad that the view actually improves when it rains.

I'm cruising with one of 13 camera crews of *Cidade Alerta*, the leading news agressivo program, meaning that the show earns a respectable 12 or 13 percent share competing against Globo's novelas. Filled with crumbling tenements, sobbing families, and faces of every color, *Cidade Alerta* is a sort of *COPS* narrated by Noam Chomsky: direct-democracy TV in which ordinary people are the subjects and the editing is minimal.

THE LEADER OF AGRESSIVO PROGRAMMING, *CIDADE ALERTA* IS A SORT OF *COPS* NARRATED BY NOAM CHOMSKY: DIRECT DEMOCRACY TV IN WHICH ORDINARY PEOPLE ARE THE SUBJECTS AND THE EDITING IS MINIMAL.

WORLDLY WIDE WEB SITES

ESSENTIALS FOR THE SMART TRAVELER

www.teleadapt.com/

Plugs and tips to keep you plugged in around the world.

www.cris.com/~kropla/index.shtml

A traveler's almanac with weather reports, travel advisories, television and electricity standards, and more.

www.mapsonus.com/

The Web's answer to the Traveling Salesman's problem, this site offers maps or turn-by-turn directions between multiple cities.

At 7:30 a.m., we arrive at a police station where some alleged murderers are being held. Correspondent Ulisses Rocha leaps from his gold Chevy Blazer, already talking into the microphone. Camera blazing behind him, Ulisses charges into the station house, interviews the police officers standing around, films the guns used in the crime, films the bullets that were in the guns, films the prisoners sitting on the floor, gets thrown out for filming the prisoners sitting on the floor, films himself being thrown out for filming the prisoners sitting on the floor, all the while chatting calmly with the viewer as if narrating a cocktail party. Outside he films the getaway car and the witnesses. He then films himself driving away from the scene.

The show delivers two-and-a-half hours a night of stabbing victims, bank robberies, jail house revolts, more stabbing victims, fires, and other delights of urban Brazil. Each segment runs with a banner summarizing the story in a half sentence: ASSAULT AT AIRPORT ENDS IN SHOOTOUT; POLICE CATCH RAPIST WHO BARBARIZED 20.

Cidade Alerta doesn't simply retail mayhem; it documents the raw wounds of poverty and social alienation in a you-are-there style. I watched one reporter take a guided tour of a poor person's refrigerator that began, "You see here a liter of milk ..." Following the police station episode, Ulisses profiles a family that has gone broke due to medical bills. "If you can help," he tells viewers, "please call," and he offers the phone number of a local charity.

The agressivo programs have pushed conservative media organizations to criticize the government *and* pushed the government towards reform. Last year *Jornal Nacional* – Globo's staid news show – ran an amateur videotape of cops beating street kids à la Rodney King, provoking a national crisis.

But today, here on the streets of São Paulo, the crime rate is unusually low. By the time the sun breaks through the clouds mid-morning, we're flat out of dead bodies and weeping mothers. But in keeping with the agressivo doctrine that anything and everything should be scrutinized, filmed, and broadcast – *especially* if the light is good – Ulisses decides to do a story about me. Suddenly I'm the one being filmed and interviewed, forced to discuss globalization and the differences between American and Brazilian television while imagining the banner that will run over my face: GRINGO SPEAKS BAD PORTUGUESE TO AUDIENCE OF MILLIONS.

There's a very Brazilian moment when the photographer I'm traveling with takes pictures of them filming us taking pictures of them – with Ulisses narrating it for the viewers and me writing it all down. It is media created in the scrappy, reinvent-on-the-spot tradition of this rising nation. The very tradition that is enabling Brazil to become a power in the emerging free-for-all global media landscape. ■ ■ ■

PHOTOS ABOVE: RICARDO FUNARI/IMPACT VISUALS

The making of *Cidade Alerta* (from left to right): correspondent Ulisses Rocha visits an impoverished family; an agressivo camera crew films dancers in a Copacabana night club; news anchor Nei Gonçalves Dias introduces the real-life stories of the *Cidade Alerta* world.

www.biztravel.com/
An encyclopedic site for global business travelers, with info on major cities and articles on laptop bags and cognac.

www.travelocity.com/
A fare-tracker email service that posts cheap deals and travel news.

www.weatherconcepts.com/FlyteTrax/
Flight departures and arrivals, and weather, in real time.

thelist.internet.com/
A catalog of Internet services and access numbers around the globe.

Upper Class

VIRGIN'S AIRPORT SHUTTLE.

We take care of you before you ever step foot on one of our planes. Because only Upper Class® by Virgin Atlantic Airways offers complimentary chauffeured service to and from each airport. Your trip to London begins when our private sedan picks you up at your home or office. Then, after enjoying our award-winning Upper Class, you'll be greeted by a Range Rover that will take you to your ultimate destination. We provide the same service upon your return. Wherever you're located, you'll be surprised by the lengths to which we'll go. And remarkably, Upper Class costs no more than a business class ticket. So try Virgin's Upper Class and you'll find that even when you're not in the air, you're still under our wing. For more information or reservations call your travel agent, Virgin Atlantic at 800-862-8621 or visit our web site at www.fly.virgin.com.

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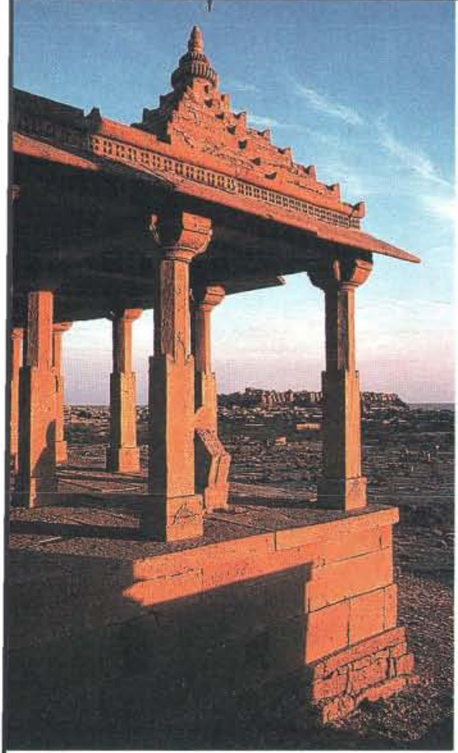
Virgin Atlantic Airways offers all non-smoking flights to Great Britain from New York (JFK and Newark), Boston, Los Angeles, San Francisco, Washington (Dulles), Miami and Orlando.

UNWIRED MECCAS

DESTINATIONS TO ESCAPE THE PRESENT, HIDE FROM THE FUTURE, AND SUBMERSE YOURSELF IN THE PAST.



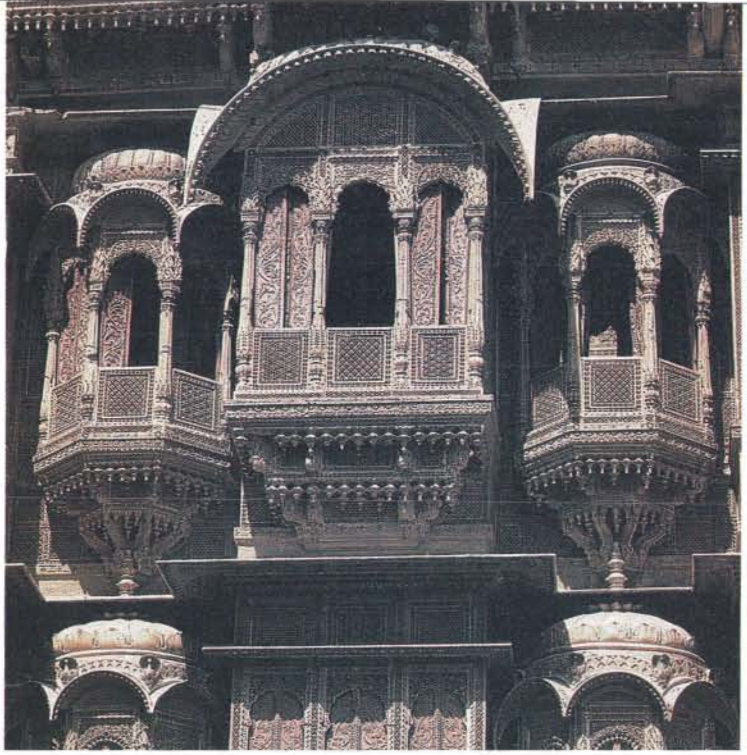


PHOTO ABOVE: RIC ERGENBRIGHT; RIGHT: FRANK GRANT; BELOW: JAMES L. STANFIELD/ NATIONAL GEOGRAPHIC IMAGE COLLECTION

JAISALMER
INDIA

Hidden away in the western corner of the Indian subcontinent, the golden fortress city of Jaisalmer rises spectacularly from the desert floor. Once a boomtown built to catch travelers along the ancient silk route, it remains a piece of the 12th century perfectly preserved.

Crowded into this labyrinthine time capsule are Jain temples lovingly chiseled into ornate shrines, and sumptuous *havelis* (the latticed mansions of powerful merchants). The city's tiny streets and squares swarm with musicians, stonemasons, and wood carvers – all leathery old men in handsome pink turbans plying their ancient trades. There is no such thing as the knowledge worker here – artisans create with their bare hands one day, and peddle it the next. Goats and cattle roam as freely as the tourists scrutinizing colorful silks and camel-skin slippers flapping from the fortress walls. Rooftop restaurants offer the best seats in the house to catch the street scene below – the only thing missing is someone snapping a clapboard and shouting, "Action, let this medieval epic begin."

If you linger, a tall, turbaned local will approach you with his "special camel safari." Sign up for one of these and let the internal GPS of a native tribesman steer you through big dunes and parched terrain. Once the sun thaws you out around 7:30 a.m., the day ahead on plodding camel is all about vast empty spaces – those around you, and the ones clearing inside your head. – *Jackie Bennion*

Fly Jagson Airlines from New Delhi to Jodhpur, where you can catch the train to Jaisalmer (a ticket for the 250-kilometer journey costs around 70 rupees or US$2). Jaisalmer Tourist Office: +91 (2992) 52406. Thar Safari: +91 (2992) 52722.

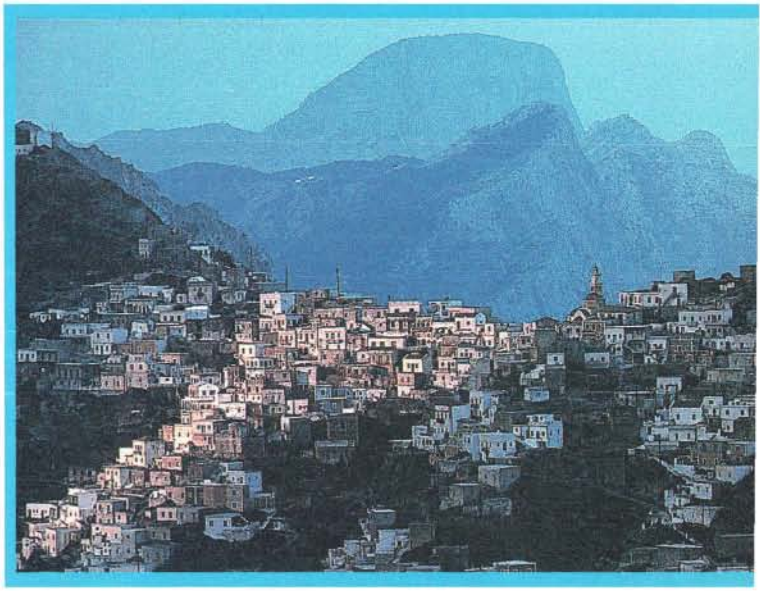
OLIMBOS
GREECE

The Greek islands, with their whitewashed Orthodox churches and the blue Aegean, have become a cliché. Though Olimbos has its share of postcard scenery, the remote mountaintop village is more intriguing than its Mediterranean neighbors. On the northern end of Kárpathos, the town seems untouched by time: There are no cars, the locals speak a Doric dialect dating back to Homer, and – most strikingly – the island remains a matrilineal society.

Wealth and family name pass from mother to eldest daughter. The men leave the island to find work and adventure, and the few that do live there – all retired mariners – can be found sipping Nescafes in the cane-backed chairs outside the Kafenion Kriti, almost as superfluous as tourists. In the early morning, women wearing long-sleeved dresses and colorful aprons pass through the maze of cobbled streets and out to the terraced fields and orchards.

The rocky shores of Kárpathos may not beckon travelers like the sandy beaches of Mykonos, but visiting Olimbos is the closest you'll come to seeing the classical Greece of Odysseus. Though unlike Homer's world, Penelope runs the show here. – *Kyle McCarthy*

Fly or ferry to the island of Rhodes. From there, take the boat to Dhiafáni, on the island of Kárpathos, where you can catch a bus to Olimbos. For a rough boat schedule contact the Rhodes Port Authority: +30 (241) 28 666 or 28 888. For more information contact the National Tourist Office of Greece: +1 (212) 421 5777.



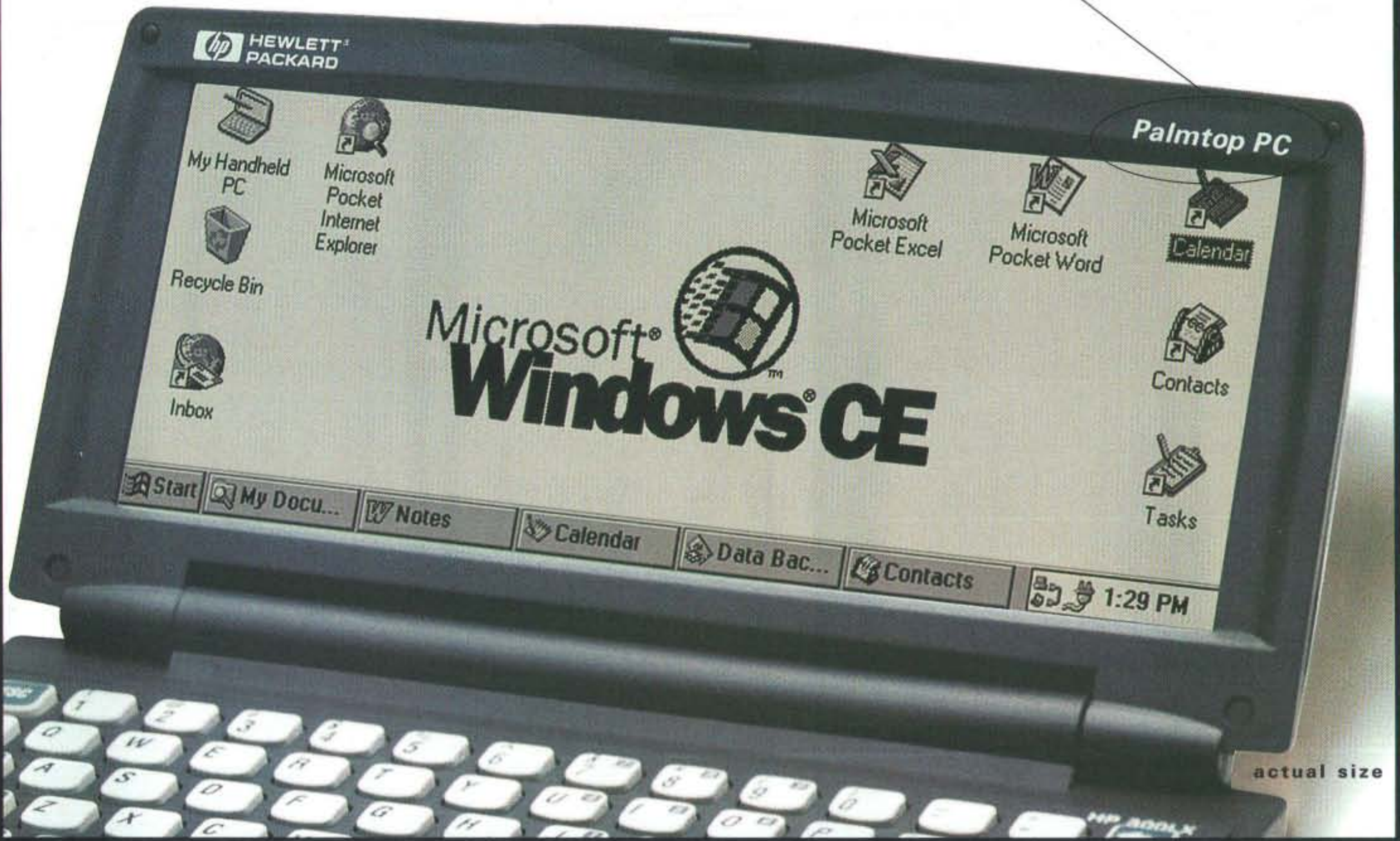
GEEK SUITES

FOR THE WIRED AND THE WEARY

While most hotels think "pay-per-view movies" is a synonym for "cutting-edge technology," a couple of chains have entered the digital age. In the Cyber Suite, at the Westin Century Plaza Hotel and Tower in Los Angeles, a voice-activated "butler in a box" will dim the lights or turn off the stereo. Call it from the road, and you'll find a hot bath waiting upon your return. The room also includes a 166-MHz Pentium computer, an ISDN connection to America Online, a 21-inch flat-panel display, a DVD player, and a cellular phone – more technotoys per square foot than Bill Gates's mansion.

For travelers who care more about REM than ROM, Hilton offers the Sleep Tight Suite in a handful of major US cities. Its Apollo Systems Light Box, an amenity for jet-lagged guests, resets the body's circadian rhythms. The SunRise Clock and Glow Lamp awakens you with a soft light. It's supposed to, at least. The rooms include a traditional alarm for the light insensitive. *Cyber Suite: US$2,000. Westin: +1 (310) 277 2000, (800) 937 8461, on the Web at* century-plazala.com/. *Sleep Tight Suite: US$125 to $365. Hilton Hotels: +1 (310) 274 7777, (800) 445 8667, on the Web at* www.hilton.com/. ■ ■ ■

The size of the screen is misleading–this is not a laptop.



actual size

So exactly where does a palmtop end and a laptop begin?

Introducing the HP 320LX palmtop PC. With a 640 x 240 VGA screen, it's the widest of any handheld PC. Six inches. And it's the first palmtop with Microsoft® Windows® CE and a built-in CompactFlash card slot for removable memory storage. You can pull the 4MB HP 320LX palmtop PC from your pocket and instantly check and send e-mail, hop on the Internet, print with the infrared connection or consult your calendar–all without lugging around a laptop. An energy-saving backlit screen allows hours of operation, and the standard docking cradle lets you easily synchronize your Windows CE applications with their Windows 95 and Windows® NT counterparts. See more: *www.hp.com/handheld* **Better products, better productivity.**

HP 320LX Palmtop PC
FROM $699*

Designed for
Microsoft®
Windows® CE

HEWLETT® PACKARD

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HOW TO HACK A CITY

THE *WIRED* BAEDEKER
FOR BUSINESS TRAVEL –
WHAT TO SEE, WHERE TO EAT, AND,
OF COURSE, HOW TO GET WIRED
IN FIVE BUSINESS CITIES.

TOKYO

TOKYO	**Wired Rating:** ✱✱✱✱✱	**GPS coordinates:** 35°40 N, 139°45 E
Voltage/Frequency (v/Hz): 100/60	**Cellular standard:** GSM	**Domain:** .jp
International code: + 81 (3)	**Phone jack:** Japanese and RJ-11	

A five-star wired city, Tokyo resembles a scene out of *Neuromancer*. It is a land infused with technology yet bound by tradition, dominated by corporations but driven with the intensity of a start-up.

GETTING WIRED:

Telephones Most phones are touch-tone. Buy a phone card, for both the green standard public phones and the grey ones with dataports, at any sidewalk vending machine or newsstand. Don't bother trying to call internationally from a public phone, or even the gold-rimmed phones marked "international." The growing phone card hacker problem forced NTT to restrict international dialing.

Net access The telephone network is dependable and the "inta-netto" is as Japanese as karaoke. Many hotels offer Net access, the grey public phones have dataports, and the Café des Pres cybercafes are everywhere.

Cell phones *Keitai* are ubiquitous, but renting one is a bureaucratic nightmare for foreigners. Docomo Sentsu's Mover Rental Center will lease to foreigners with a passport and visa, and a Japanese sponsor. It costs ¥1,500 (US$13.15) a day for the first seven days, or ¥22,200 (US$194.61) per month; ¥50,000 (US$438.30) deposit; service charges not included. Closed weekends. Contact: +81 (3) 3282 0100. Some hotels rent to guests. If you do get your hands on one, respect Japanese etiquette and don't make calls in public places such as hospitals, the subway, or the Tea Garden at the Hotel Okura.

WHAT TO SEE:

Akihabara The classic wired mecca, this electronics emporium is located near the Akihabara subway station. Bring cash. And bargain.

InterCommunication Center NTT's multimedia center mounts exhibits by Toshio Iwai, Karl Sims, and others. Located in the Tokyo Opera City Tower, a complex which is home to NTT, AOL Japan, Microsoft, and the new national theater. Contact: +81 (3) 5353 0800, email *query@ntticc.or.jp*, on the Web at *www.ntticc.or.jp/*.

Maruhan Pachinko Parlor Japan's Vegas. Wager a few yen at this swank digital gambling parlor, or just observe the national obsession. In the 109 Building in Shiduya. Contact: +81 (3) 5458 3905.

Toto Company showroom This high tech toilet company showroom includes one model that will analyze your output and offer dietary advice. Contact: +81 (3) 3345 1010.

WHERE TO EAT:

Yakitori The stalls beneath the Ginza or Shinjuku train tracks make the best Japanese barbecue in Tokyo.

Midori Sushi The wait is long but the food is affordable (¥8387 or US$75 for four people compared with $75 for four pieces at most hotels).

Keat's This karaoke bar boasts 3,000 songs in English. Contact: +81 (3) 3584 3262.

WHERE TO SLEEP:

In general Many downtown hotels offer business centers with everything from secretarial support to computer equipment.

Hotel Okura Rooms include fax machine, RJ-11 jack, and multiple phone lines. PCs and cell phones – in addition to language and basic administrative services – are available. This Frank Lloyd Wright-designed hotel is based in Minato-Ku. Contact: +81 (3) 3582 0111, fax +81 (3) 3582 3707.

Park Hyatt Rooms have fax machines, two phone jacks (not RJ-11s), a direct outside line, and CD/laserdisc players. The hotel rents cell phones and has a full-service business center; both ballrooms have a video wall. It's located in Shinjuku, a 13-minute walk from the busiest subway station in the world. Gates stays here. Contact: +81 (3) 5322 1234.

Westin Basic rooms are less wired than the above hotels – the hotel provides adaptors but no US plugs, personal fax machines but no cellular rentals. Try the Guest Office Suites, which provide everything from PCs to highlighters. In Meguro-Ku, an old industrial neighborhood filled with restaurants and hip clubs. Contact: +81 (3) 5423 7000.

TIPS:

ATMs *Kyashu mashin* abound, but close early (at 9 p.m. on weekdays and 5 p.m. on weekends); many add a surcharge after 6 p.m. and on weekends. Citibank's machines are open 24-7 but are few and far between. Carry lots of cash – Tokyo is safe and cash is the easiest form of payment.

www.so-net.or.jp/tokyoq/ More quirky Tokyo treats than you could fit into one trip.

The only deal in Japan? A Japan Railway pass gets you on bullet trains, and Tokyo's smaller subway and bus systems. You must buy the pass outside of the country. Contact: +81 (3) 3215 9649, +1 (212) 332 8686, email *japanrail@aol.com*.

LONDON

LONDON	**Wired Rating:** ✱✱✱	**GPS coordinates:** 51°30 N, 0°10 W
v/Hz: 220/50	**Cellular standard:** GSM	**Domain:** .uk
International code: +44 (171), outer London (181)		**Phone jack:** British

High tea is still more respected than high tech, and only 5 percent of the population owns a computer. Still, the country that gave us raves and demo culture is far from unwired.

GETTING WIRED:

Telephones Although the infrastructure is impressive, with more high-bandwidth optical cables than the US, other elements of British telecom seem relatively backward. There is no flat-rate service, for instance, so every minute counts – even for local calls.

Net access Major US providers have local POPs, but take note – many hotels charge per minute for local calls. Rent a cellular and use a PC Card modem for wireless access. There's always the original Cyberia café on Whitfield Street, where you can get doubly wired. Contact: +44 (171) 734 8300.

Cell phones Renting a cellular in London is like drinking a good beer: cheap and easy. Adam Phones: £5.95 (US$10) a day with £300 (US$490) deposit; longer-term rates available. Contact: +44 (181) 742 0101. Odyssey: £9 (US$14) a day with a £750 (US$1,223) deposit, longer-term rates available. Contact: +44 (171) 490 7000.

WHAT TO SEE:

Shoreditch London's new media area. Caffeinate with the ditcherati at The Bean. Contact: +44 (171) 739-7829.

Greenwich Picnic on the international dateline and see the spot that will lead London into the next millennium.

The Difference Engine See the cutting edge of the *last* millennium at The Museum of Science Industry, an impressive seven stories of UK science. Contact: +44 (171) 938 8000.

Big Ben An analog classic. But time is money – in this case £15 to 20 (US$24 to $32) to climb the tower.

WHERE TO EAT:

OXO Tower Bar & Brasserie The spot for the hot publishing crowd. Modern British and Mediterranean cuisine and the London skyline. At the OXO Tower Wharf on the Thames's south bank. Contact: +44 (171) 803 3888.

Belgo Central This Covent Garden restaurant serves *moules et frites* as good as any found at the other end of the Chunnel. Contact: +44 (171) 813 2233.

Atlantic Go for a drink at this hip, velvet-walled bar, but come with an attitude. Contact: +44 (171) 734 4888.

WHERE TO SLEEP:

The Athenaeum This small spot on Green Park is the most wired hotel in London. Rooms have multiple phone jacks, fax machines, and the hotel can provide electrical adaptors and a cell phone. A computer center includes a Pentium PC with Net access. Contact: +44 (171) 499 3464, on the Web at *www.athenaeumhotel.com/*.

Hazlitt's The reincarnation of William Hazlitt's 18th-century house is low on digital and high on style. But it does have the very basics – like an outside line. In Soho, the media heart of London. Contact: +44 (171) 434 1771.

TIPS:

Hacking Heathrow If you fly business class, don't miss the biggest perk: the "fast track." This route through customs bypasses the mob. Call A-Line Cars to order a limo into London: +44 (171) 793 0000. Or take the Tube.

PHOTOS: WENDI NORDECK

HOW TO HACK A CITY

MILAN

Wired Rating: ●●
GPS: 45°28 N, 9°10 E
v/Hz: 220/50
Cellular standard: GSM
Domain: .it
International code: +39 (2)
Phone jack: Italian, RJ-11 less common

Milan is the business capital of Italy, a veritable runway of international fashion, and a high tech dud. Business travelers should come with plug adaptors and patience.

GETTING WIRED:

Telephones Tone and pulse. And not cheap, thanks to the national monopoly.

Net access It is often easier to connect using pulse; speed dialing mix-ups are not uncommon with touch-tone phones.

Cell phones *Telefoni cellulari* (or *telefonino*) can be rented at: Poker Quattro Srl: +39 (2) 59 90 26 04, fax +39 (2) 59 90 07 57; ABC Telecom (which has a booth at the airport): +39 (2) 77 291, fax +39 (2) 77 29 40.

WHAT TO SEE:

Quadrilatero d'Oro To leave Milan without visiting this area of designer boutiques and galleries would be a fashion faux pas.

The Centro Sociale Conchetta A live/work arts co-op that puts on cultural performances and multimedia exhibits. Contact the Calusca City Lights Library: +39 (2) 58 10 56 88

WHERE TO EAT:

Bar della Crochetta Arrive before 1 p.m., when the business lunch crowd pours in for the bar's hoagie-sized sandwiches.

The Atlantique This bar and restaurant draws the chic cellular set after hours. Contact: +39 (2) 5519 3906.

WHERE TO SLEEP:

The Four Seasons Rooms have 110-volt US electrical adaptors, multiple RJ-11 jacks, and a direct outside line. Hotel will provide cell phone on request, and all the other Four Seasonal luxuries. Contact: +39 (2) 770 81.

Starhotel Ritz and Starhotel Splendido Executive suites include multiple phone jacks and fax machine. Cell phones available. Ritz: +39 (2) 2055. Splendido: +39 (2) 6789.

TIP:

Taxis don't cruise the streets in Milan, so you can't hail a cab. Call: 6767, 5353, or 8585.

SYDNEY

Wired Rating: ●●
GPS coordinates: 33°53 S, 151°2 E
v/Hz: 240/50
Cellular standard: GSM
Domain: .au
International code: +61 (2)
Phone jack: Australian and RJ-11

A magnet of international attention and commerce, Sydney could be a digital power of the Pacific Rim. Yet the infrastructure is surprisingly behind, and the digital scene is fledgling.

GETTING WIRED:

Telephones Dependable touch-tone network. Phone cards are sold at newsstands and other stores. The national telco plans to replace public phones with high tech ones capable of voice and data transmission.

Net access If you're used to a T1, surfing in Sydney can be like watching paint dry.

Cell phones MAN Phone rental is highly recommended. Contact: +61 (2) 9555 1125. Optus Mobile Rentals lets you pick up a cell – or a satellite – phone at the airport Budget Rent-a-Car. Or call – in advance – to have one delivered to you. Contact: +61 (3) 9205 3040.

WHAT TO SEE:

Powerhouse Museum Art and technology in Darling Harbour. Ask nicely and Matthew Connell, a curator of information technology, might show you his "new" Babbage Engine sections. Contact: +61 (2) 9217 0111.

Sega World The name says it all. In Darling Harbour. Contact: +61 (2) 9273 9111.

Watson's Bay Go offline and drive up the S's (aka, New South Head Road), stopping at the Convent for photos and at Doyle's Fish restaurant for stuffed prawns and lobster lunch. Contact: +61 (2) 9337 2007.

WHERE TO EAT:

Bel Mondo The place to see and be seen. Ditto for the chefs, who work on a raised platform at the center of this restaurant at the Rocks. This is food as theater, and the show is a winner. Contact: +61 (2) 9241 3700.

The Bathers Pavilion The quintessential Sydney meal: lots of seafood, Asian influences, and fabulous wine. On Balmoral Beach close to Mosman. Contact: +61 (2) 9968 1133, fax +61 (2) 9969 4626.

The Oyster Bar and The Basement In the Circular Quay. The sysadmins sip and the suits slack off at these bars.

WHERE TO SLEEP:

The Observatory Hotel The swankiest in Sydney. Rooms have multiple phone lines and RJ-11 jacks. Fax machine, laptops, and adaptors available; cell phone rentals can be arranged. Contact: +61 (2) 9256 2222.

Hotel Inter-Continental Club Floor rooms at this high-end business hotel include RJ-11 plugs; fax, pager, and mobile phone available. Computer center with PCs, printer, and Net access open to all guests. Contact: +61 (2) 9240 1200, fax +61 (2) 9240 1240.

TIP:

Adaptorless? If you're missing the plastic gizmo you need to hook into the electrical outlet, try a pair of pliers and a little force on your regular plug – it should work.

HONG KONG

Wired Rating: ●●●
GPS coordinates: 22°15 N, 114°10 E
v/Hz: 220/50
Cellular standard: GSM
Domain: .hk
International code: +852
Phone jack: British, some RJ-11

Hong Kong is a magnet of foreign investment, the world capital of Chinese food, and a greenhouse for digital activity. Net use is projected to hit 2 million by 2000. China permitting, of course.

GETTING WIRED:

Telephones Mostly touch-tone. Getting a phone line is rarely a problem – the network is dependable, and because local calls are free most businesses have a telephone for free public use. Long distance callers should use the Home Direct service: dial 001 plus 800 1111 for an AT&T operator, 800 1121 for MCI, 800 1877 for Sprint.

Net access ISPs are on the rise, costs are falling, and for the moment HK's network backbone runs at 28.8 Kbps.

Cell phones Hongkong Telecom's Mobile Customer Care Center rents handsets for HK$150 (US$19) per day for the first three days with a HK$3,000 (US$380) deposit. Airtime charges are deducted from a prepaid phone card. Reserve a phone – and get your number – in advance. Contact: +852 2893 6878.

WHAT TO SEE:

Hong Kong Stock Exchange People in the financial industry can take stock of the fifth largest exchange in the world. Visitors must call ahead. Contact Mr. Henry Lan: +852 2840 3862, fax +852 2845 3554.

Hongkong and Shanghai Bank headquarters Norman Foster's billion-dollar steel and glass 'scraper is the most expensive building in the world. Even I. M. Pei's soaring Bank of China Tower, nearby, pales in comparison.

The Star Ferry Go offline, and off-shore.

WHERE TO EAT:

Yung Kee It's worth a trip to Hong Kong just to taste Yung Kee's roast goose. And by no means should you skimp on the sumptuous

dim sum. Contact: +852 2522 1624.

Harlequin Bar Get high on Hong Kong with a cocktail at the top of the Mandarin Hotel. Walk down the hall to Pierrot or Man Wah for haute French or nouveau Chinese. Contact: +852 2522 0111.

WHERE TO SLEEP:

The Regent Hong Kong Every room is PC and fax ready. The hotel also includes two boardrooms, a biz center, and a secretarial staff. In other words, the expense is worth it – if you can expense it. Contact: +852 2721 1211, fax +(852) 2739 4546.

The Peninsula This luxurious grand dame caters to executives. High tech amenities include electric curtains and voice-activated phones. On the tip of Kowloon. Contact: +852 2366 6251.

The Kowloon Hotel This pleasant hotel offers email, fax machines, and satellite TV – at some of the best rates in Hong Kong. Contact: +852 2369 8698, fax +852 2739 9811.

TIP:

www.biztravel.com/ Wear a suit, bring bilingual biz cards, and other HK etiquette.

PHOTOS: WENDI NORDECK

NED

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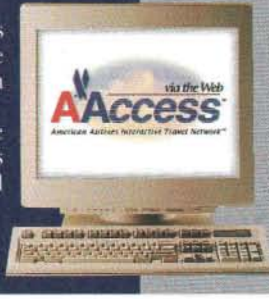
MARIE

Marie knows she's AAdvantage member 2NC0284. She currently has a total of 134,788 AAdvantage miles, and only needs 9,028 more this year to maintain AAdvantage Gold® status. She recently earned 4,345 miles on a sales trip. And she and her boyfriend, Hal, used 50,000 miles when she took him to meet her parents in Chicago. Oh yeah, she also knows how to change the address on her AAdvantage account (say, when she gets married) should the need ever arise.* Not that she's holding her breath, Hal.

Why does Marie know so much? Because she uses AAccess℠ – the American Airlines Interactive Travel Network℠, available on the web or with Personal AAccess℠ software.

With AAccess, Marie can manage her AAdvantage account right from her computer. Which includes tracking her AAdvantage miles from flights, hotel stays and rental cars. Booking and purchasing tickets. Looking up flight information. And using the new AAdvantage Locator Map, which helps Marie find ways to earn extra AAdvantage miles when traveling. She can also check out low Net SAAver Fares℠ as well as special AAdvantage promotions. Like the one going on now, where you earn up to 500 bonus miles for every round trip on American and American Eagle® booked using AAccess and completed by the end of the year.

So visit AAccess via the Web℠ on the Internet. Or, for a Windows®-based link to American Airlines, call for our Personal AAccess software.



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For Internet users, *AAccess via the Web* is located at **www.americanair.com** To order *Personal AAccess* for your PC, call **1-800-AACCESS (222-2377)**.

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GEEK GEAR

THE BASICS

total weight: 17 pounds

① TUMI SAFECASE LAPTOP BAG (NYLON)

5 pounds, 15.4 ounces

Well designed. Lots of pockets. "Self-healing" fabric – no really – puncture holes disappear. This bag will outlast your laptop.

Tumi Safecase: US$250 to $335 nylon, $425 to $525 leather. Tumi: (800) 322 8864, +1 (908) 271 9500.

② POWERBOOK 3400c/240, INTERNAL 33.6 MODEM

7 pounds, 3.2 ounces

Apple's top machine dusts any Pentium on the market: 240-MHz PowerPC processor, 16 MB RAM, 12.1-inch active matrix screen, 2- to 4-hour rechargeable lithium ion battery, and all the serial ports and PC slots you could need.

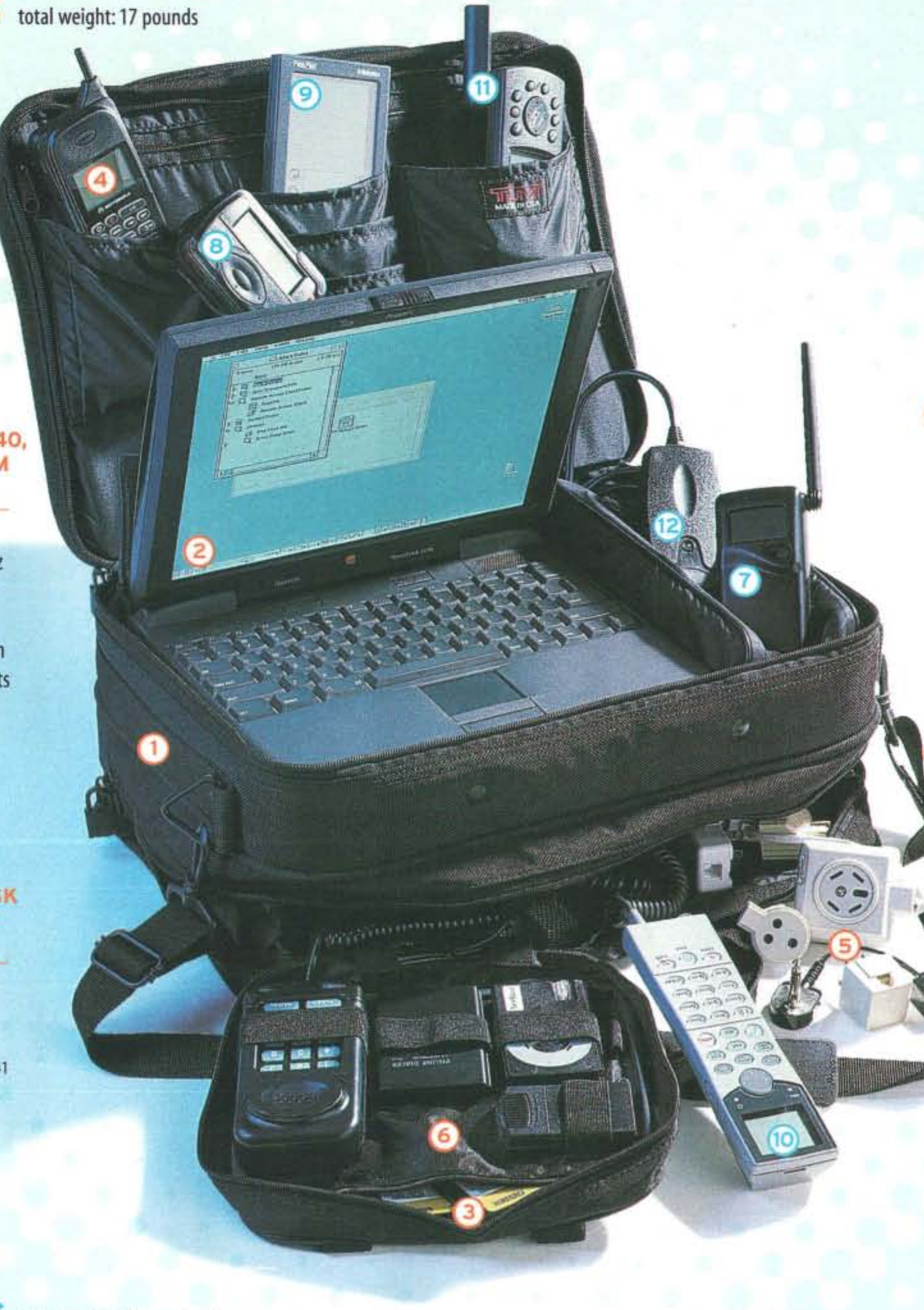
PowerBook 3400c/240: US$5,999. Apple: (800) 793 2378, +1 (408) 996 1010, on the Web at *powerbook.apple.com/*.

③ BOOT DISK AND NORTON UTILITIES DISK RECOVERY SOFTWARE

0.8 ounces

Think of them as jumper cables for the wired traveler.

Boot Disk: Comes with your PC.
Norton Utilities: US$99. Symantec: (800) 441 7234, +1 (541) 334 6054, on the Web at *www.symantec.com/*.



④ MICROTAC INTERNATIONAL 8800

5.5 ounces

Take the sleekest US cellular to Asia or Europe, and it's just a stylish piece of plastic, incompatible with the GSM service on those continents. So the ultimate cell phone for the wired traveler is dual standard. Motorola will be first to market early next year.

MicroTAC International 8800: US$165 to $215. Motorola: (800) 331 6456, +44 (1) 256 790173, email *cic@csg.mot.com*, on the Web at *www.mot.com/*.

⑤ TELEADAPT WORLD PAK

1 pound, 3.5 ounces

The united plugs of TeleAdapt – this kit includes telephone adaptors to help you connect from Sweden to Singapore and anywhere in between.

TeleAdapt World Pak: US$450. TeleAdapt: +1 (408) 965 1400, email *info@us.teleadapt.com*, on the Web at *www.teleadapt.com/*.

⑥ TELEADAPT EXECUTIVE TELEKIT

2 pounds, 3.6 ounces

When the phones are hardwired (the line disappears into the wall rather than plugging into an outlet), you'll need this toolkit: pocket phone, tone dialer, RJ-11 doubler and coupler, 8 ½-foot retractable phone cord, alligator clips, line tester, screwdriver set, and flashlight. The kit also includes two useful books: *Travels with a Laptop* and *TeleAdapt Connectivity Guide*.

TeleAdapt Executive TeleKit: US$105. TeleAdapt: see above.

THE EXTRAS

total weight: 7 pounds, 11 ounces

⑦ METRICOM RICOCHET

8 ounces

This wireless Net service is available in a growing number of US cities and a dozen major airports.

Ricochet: US$349, plus $29.95 a month for mandatory ISP connection (for $5 more, you can connect to other online services or ISPs). Metricom: (800) 469 4735, +1 (408) 399 8200, on the Web at *www.ricochet.net/*.

⑧ SKYTEL 2-WAY PAGER

6.1 ounces

Email, voicemail, address book, and news flashes wrapped into a tiny package. Runs for weeks on a single AA battery. Necessity or addiction?

SkyTel 2-Way: US$399 or $15 a month to rent, plus $24.95 to $49.95 a month for service. SkyTel: (800) 801 2480, +1 (601) 292 8915, on the Web at *www.skytel.com/*.

⑨ PILOT PRO

5.7 ounces

This calendar-address book-memo pad-email device synchs with your desktop and fits in your pocket – and it's still the best PDA around.

Palm Pilot Pro: US$399, attachable modem $129. US Robotics: (800) 881 7256, +1 (408) 848 5704, on the Web at *www.usr.com/palm/*.

⑩ COMSAT PLANET 1 SATELLITE PHONE

5 pounds, 3 ounces

Sometimes the heavens are the only way to make a call. Just pray sat phones get cheaper and lighter.

Planet 1: US$2,995. Service averages $3 a minute, plus a $25 monthly charge. Comsat Planet 1: (888) 752 6381, +1 (301) 214 3500, email *planet1@comsat.com*, on the Web at *www.comsat.com/planet1/*.

⑪ GPS II PLUS

9 ounces

Wherever you go, there you are. And Garmin's handheld tells you where "there" is. The 2.32-by-5-by-1.62-inch unit stores routes and maps and runs 24 hours on four AAs.

GPS II Plus: US$386.35. Garmin: +1 (913) 397 8200, on the Web at *www.garmin.com/*.

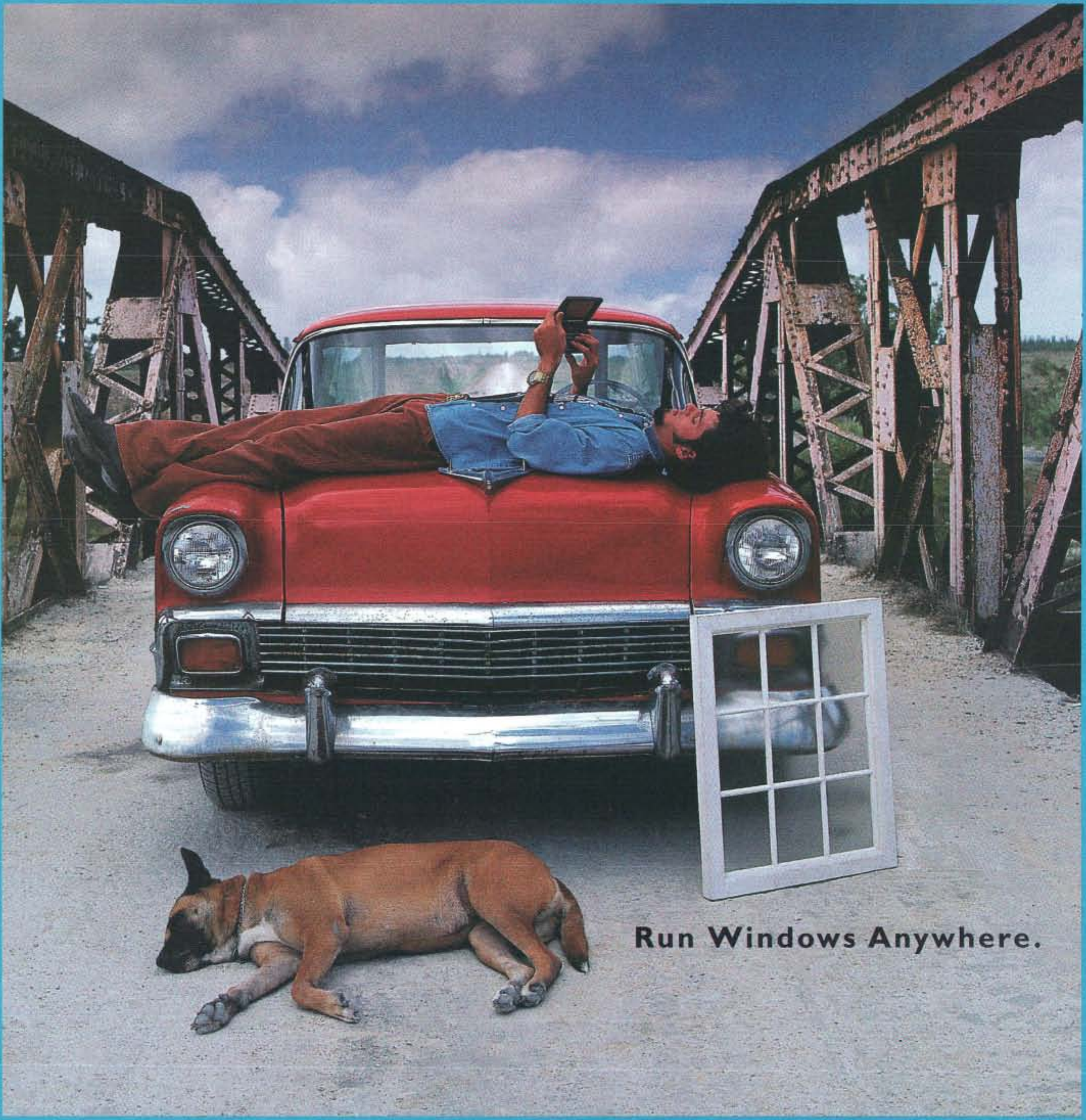
⑫ THE POWERXTENDER

11.2 ounces

This adaptor lets you plug your laptop into the EmPower in-seat power outlets on United, Delta, and American planes and into any car or boat cigarette lighter.

PowerXtender: US$99. Xtend Micro Products: +1 (714) 699 1400, on the Web at *www.xmpi.com/*.

PHOTO: WENDI NORDECK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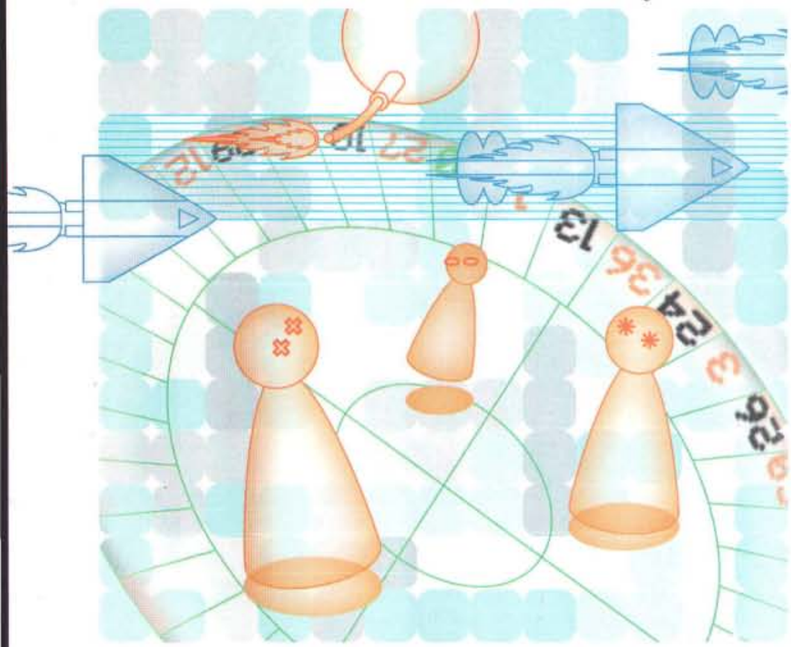
The Bleeding Edge

If you're looking for what's next in online technology and commerce, just follow the gamers.

By Colin Berry

Dennis Fong is sitting in his Silicon Valley bedroom, framed by posters of Mariah Carey and Michael Jordan and a border of Dean Koontz paperbacks. Dressed in Stüssy cap and Gap shirt, Fong is a gentle and polite 20-year-old, chilling out after community college class by playing a game of *Quake* on his PC. Under the influence of the game, however, mild-mannered Fong morphs into Thresh, a badass, bomb-lobbing bully who loves to spill blood and roll heads.



Online gamers aren't just chasing monsters with nail guns. They're paving roads to the future by endlessly pushing the limits of networking technology, mastering ecommerce and building immersive electronic worlds.

Thresh is trolling a labyrinthine dungeon in search of a nail-gun-wielding thug, intent on reducing him to a smoking hunk of riddled flesh. Girded with extra armor, a grenade launcher, and a "ring of shadows" that renders him invisible, Thresh has taken the offensive, pursuing the scumbag down ramps and up darkened stairways. He passes strange weapons that hover in midair; torches flicker on the wall. During the fight, CrockMe, his foe, regularly fires off a flak stream that reverberates through the stone tunnels like Hell's own thunderclap.

Dizzying, disorienting, violent, and incredibly fun, the realm of Thresh is exploding under our noses. More than a pastime for undergraduates blowing off steam, the multiplayer online gaming community explores and extends the digital frontier - pushing new technology to its performance limit, creating effective ecommerce, and building immersive electronic worlds. What's happening online ultimately ripples into larger worlds. "As gamers go, so goes the nation," explains Robin Raskin, computer journalist and editor in chief of *FamilyPC*. "If you want to know where the rest of us will be in 12 months, look to the gaming community."

The chief goal of most gamers and game companies is to more seamlessly merge the real world with the electronic one. And one thing is clear: just wandering around killing monsters has become boring.

Dialing for dollars

The growth of online gaming is expected to rapidly accelerate in the next five years, from an estimated 1.5 million households in 1996 to 23 million by 2001, according to a report by International Data Corporation/Link. Driving that incredible expansion is the amount of gaming options that will become available. Some 30 to 40 Internet-enabled games will find their way to store shelves in 1997 and 1998; last year, there were fewer than half a dozen.

Yet the fact that only 6 percent of online households play games demonstrates how unappealing most Net environments are, says Nick Donatiello, president and CEO of Odyssey, a San Francisco-based research firm. There's a huge incentive to change that, he says: "Entertainment is extremely important, yet the PC is sold as a productivity device. The PC needs a new identity as an entertainment device."

Adds Jack Heistand, president and CEO of Total Entertainment Network: "Every new medium has a critical application driving its success. In home video, it was the exercise tape and kids' titles. Games

IMAGE: B. RADOSAVLJEVIC

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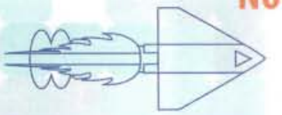
are a means of bringing people together, and the Internet takes the game experience to a new level."

The question for entrepreneurs becomes how to turn this new direction into dollars. More than a dozen online gaming services - CyberPark, Heat.net, Engage, Battle.net, MPG Net, Dwango, TEN, Kali, and Mpath, among them - jockey for a share of the action. Together they scramble for an online market that Forrester Research expects to gross more than US$1.6 billion by 2001. But how to get there? While there are a seemingly infinite number of ways to lose money online, it appears that there are still very few ways to earn it.

Online gaming is expected to gross $1.6 billion by 2001.
Now comes the tricky part:
figuring out how to get there.



Today, most gamers are not paying to play online, the IDC/Link survey says. Only a relatively small number shell out fees for premium clubs or services like TEN or Kali. Instead, several online game providers are borrowing the cable TV industry's business model and offering a multitier pricing structure that includes free services as well as hourly and daily rates. iMagic Online, for instance, plans to adopt a multilevel strategy that offers free chat rooms and demos, as well as basic and premium services. In July, America Online started charging $1.99 an hour for multiplayer gameplay on top of its $19.95 flat monthly rate. Microsoft, too, has unveiled a layered approach on its Internet Gaming Zone: customers can compete against each other in selected multiplayer games and board games such as backgammon free of charge, or they can pay a daily fee for "premium" multiplayer Internet games. Microsoft is expected to charge roughly $1 to $3 per day for premium games like *Fighter Ace*, expected to be released this autumn, and *Asheron's Call*, which will arrive next year.

Gamers, however, are not happy with the changes. Some have even contacted their state's attorney general, saying that they have been hit by bait and switch. After being promised unlimited access, they are now charged for some of the most popular games. Angry players in the AOL community have even started a protest group that drafts petitions and organizes letter-writing campaigns.

Yet within this hothouse of controversy, some important seeds of ecommerce have begun to germinate. SegaSoft possesses what might be the most revolutionary idea

WAS AT WORK.

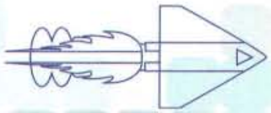
Computer Living room Home theater Stadium Studio Concert hall

yet about how to bankroll Heat.net, its internet gaming network. The company has teamed with San Francisco's PostLinear to create a revenue model using limited-edition digital objects (LEDOs). By early next year, Heat.net members will be able to buy, sell, and trade these virtual objects (typically weapons, characters, abilities, tricks, information, and other game-enhancing assets) using a technology called Transactor, which keeps track of ownership and payment records. LEDOs are estimated to cost between 50 cents and $15 each and will be included on the customer's monthly bill. Purchases can take place during the game, in a chat room, or off the network entirely. Players retain possession and ownership of LEDOs when they log off the network.

"Transactor technology is no mere add-on to Heat," says Gary Griffiths, SegaSoft president and CEO. "Transactor brings the essence of a real-world market economy to the Heat network."

SegaSoft will implement Transactor technology on three titles: *Ten Six*, *Vigilance*, and *Skies*. When you buy the *Ten Six* game disc and log on, for instance, you are given a plot of land and a random collection of tools. Transactor ensures that your starting setup will be different from anyone else's. It's entirely possible that your plot of land is near a limited-edition object, like a superbazooka, of which there may be only 50 per game. If you're one of the lucky superbazooka owners, you enjoy both a military and an economic advantage. Other gamers in your world can offer you anything in trade, from other items to in-game money to real dollars and cents.

Earth-shattering electronic superbazookas may be the currency that help trigger ecommerce's acceptance.

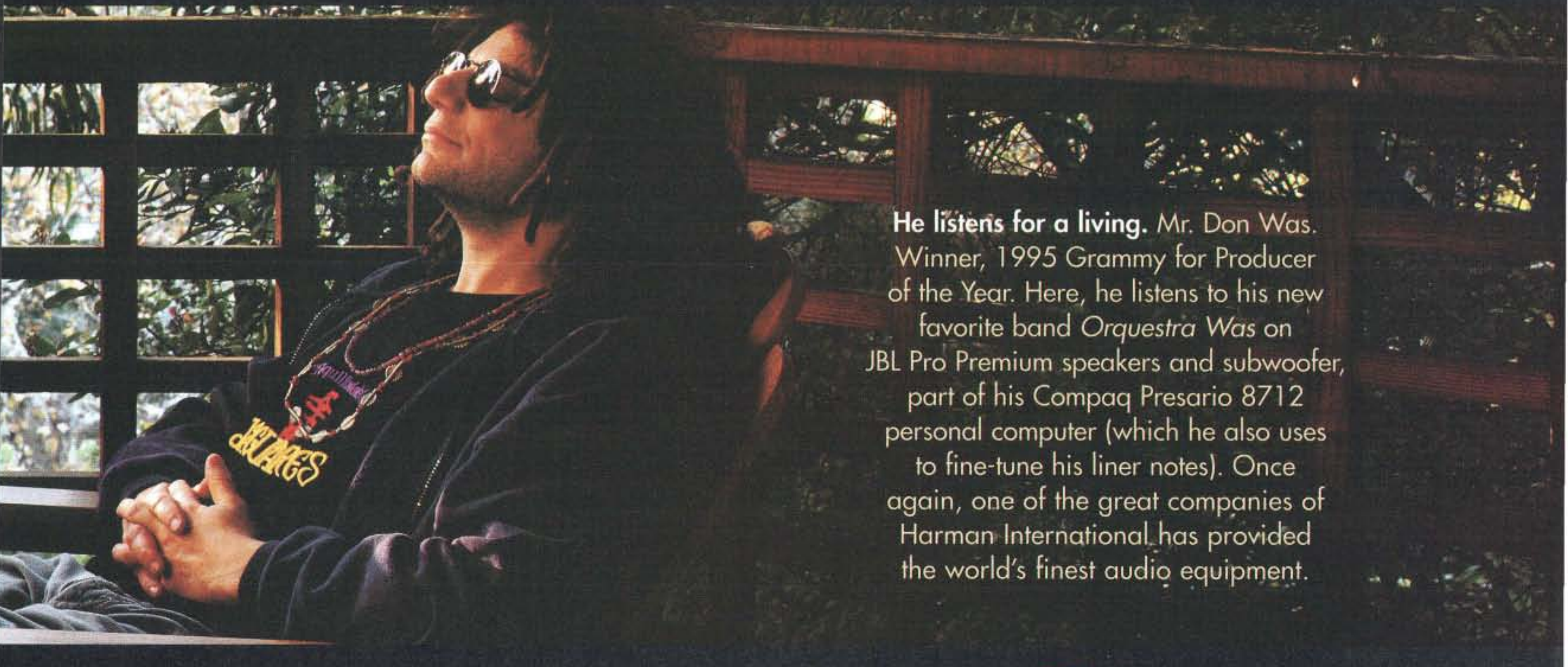


Players can sign on to Heat.net free of charge, paying by secured credit cards only for those LEDOs they use within the game.

But LEDOs are not without controversy. "They go against the gaming ethic," says Marty Schoffstall, CEO of gamemaker TimeSink in Harrisburg, Pennsylvania. "Anyone who has the money can pay to have all the advantages. With most games you need to invest the time to become an expert. With LEDOs, if you spend enough money, you can beat anyone."

Nonsense, says former SegaSoft vice president and general manager Peter Loeb. "We're creating a new economic model based on incremental investment," he says.

harman/kardon JBL Infinity



He listens for a living. Mr. Don Was. Winner, 1995 Grammy for Producer of the Year. Here, he listens to his new favorite band *Orquestra Was* on JBL Pro Premium speakers and subwoofer, part of his Compaq Presario 8712 personal computer (which he also uses to fine-tune his liner notes). Once again, one of the great companies of Harman International has provided the world's finest audio equipment.

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More important, the company is taking a very real stab at defining the future of online barter.

Building communities

The legend, of course, is that engineers designed the Net to withstand the ultimate wargame: global thermonuclear war. In truth, the Net originally served interlinked communities whose members loved friendly competition. Even in its earliest incarnations, the Net attracted enthusiasts who used it as a competitive arena. Early adopters populated a variety of networks and became fanatics of Dungeons & Dragons, *Star Trek*, and similar titles. BBSes supported role-playing MUDs - fantastic, organic worlds that used text-based chat functions. Sierra's ImagiNation Network offered early simulation games such as *Red Baron* and *3-D Golf*, as well as electronic versions of backgammon and cribbage, while Nets like LINC supported e-chess tournaments with up to 30 participants.

Online gamers continue to exploit the Net's predilection for community-building. They hang out on IRC or in chat rooms, arranging contests and swapping stories; they readily take to building clans - alliances formed among players united by geography, skill level, or shared vision. Virgin Interactive's press release for *SubSpace* goes straight for the jugular : "Thousands of Gamers from Around the World Meet and Interact," it promises, "Then Kill Each Other!"

"Being a member of a well-known clan adds to how well you're respected," explains Jen Press, a teenage *Quake* champion and affiliate of Psycho Men Slayers, a clan whose members hail from British Columbia, North Dakota, Utah, and Washington. (See "Quake Girls," *Wired* 5.04, page 39.)

Despite their affinity for blowing each other to shreds, gamers have also created elaborate communities. Mplayer, for instance, boasts 130,000 members.

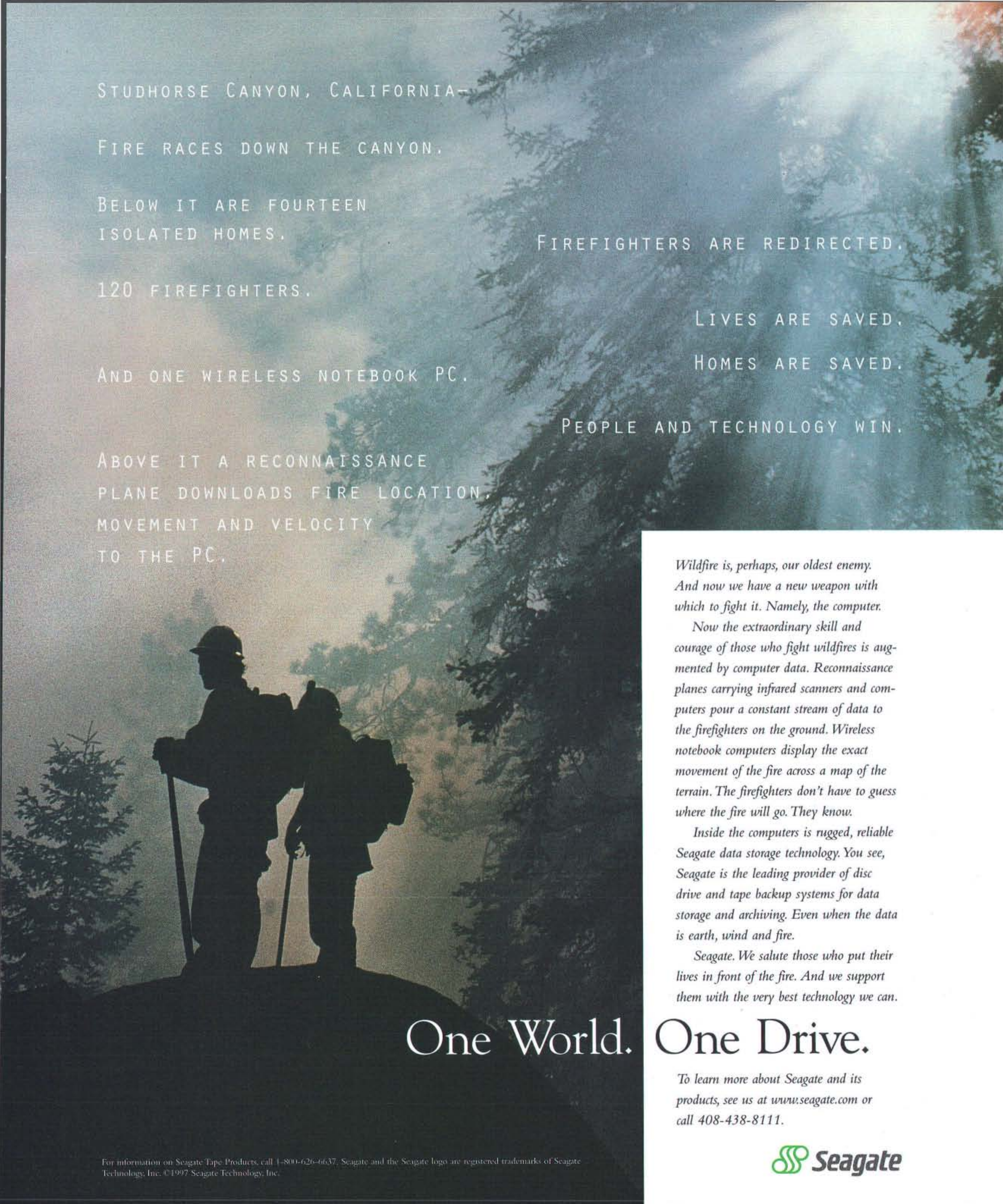
But if bloodthirsty gamers have been adapting since the Net's early days, gaming companies - those whose business it is to provide players with a reliable competitive environment - are a fresh breed still struggling to build truly immersive online worlds. One of the best, created by TEN, feels like a cross between *The X-Files* and *Blade Runner*. Spooky and futuristic, TEN is conducive to whiling away hours fragging, shredding, or fantasizing.

Mpath Interactive's Mplayer site, on the other hand, has a simple and clean design that stands in contrast to TEN's shadows. Mplayer launched in October 1996. So far, more than 130,000 gamers have joined the service. Mplayer offers several of the Net's most popular games, from *Red Alert* and *Command & Conquer* to *Scrabble* and *Battleship*. Fast, reliable, and sleek, Mplayer tempts gamers with real-time speech features and ScribbleTalk, a whiteboard on which players map tactical assaults.

Like its competitors, Mpath is betting heavily that multiplayer gaming will support its estimated $10 million business. To succeed, the company must build a reliable network, create and maintain proprietary software systems, and court a fickle audience, convincing them that Mplayer's game selection is better and faster.

"This is the most complex business I've seen," admits Mpath president and CEO Paul Matteucci, a round, impatient 16-year veteran of the tech industry. "You've got artistic stuff, you're operating a network, you're building technology. The product lives every day. And *you* don't control how it changes - your user does."

That observation is key. Particularly appealing are games wherein players team up and use the skills of others to gain experience and thus have more fun. Activision's



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NetStorm, for instance, encourages players to collaborate and create civilizations or warring alliances. In this fantasy world, the game continues even after individuals go offline or get disconnected. Likewise, Fenris Wolf's new *Rebel Moon Rising* allows players to join in a game of capture the flag. Players can hook up over their Internet services or find teammates and opponents at *www.fenriswolf.com/*. Several manufacturers are also creating technology that will free gamers from communicating via the keyboard. Both *Rebel Moon Rising* and Multitude's *FireTeam* use speech-recognition technology that allows voice commands. *Rebel* players can ask the PC to retrieve weapons or maps and shout orders to teammates. Voice commands pop up as text onscreen.

Some of the more enlightened gaming companies also use the Internet's strength as a distribution mechanism, and actively seek input from players in designing their environments. TimeSink's *WarSport* - a futuristic football game in the Mplayer Free Zone in which eight players (each commanding a 50-robot team) compete in 20-minute battles - promises monthly improvements based on comments from players. "It's a continual work in progress," says TimeSink's Schoffstall. "Every month we're going to tweak and fine-tune. We've got to get rid of this 'once and done' mindset. It's presumptuous."

Permanence is a thing of the past online.
Games evolve on a monthly basis.
Every site is a continual work in progress.

Tech troubles

But as gamers blaze the Net's future, no start-up has fully addressed online gaming's central technological problems, difficulties that keen features, cool ambience, and groundbreaking business models cannot counter. The Achilles' heel of online gaming is latency - the time it takes for a player's command to traverse the Internet and appear onscreen.

Thresh is standing in a doorway where he can observe CrockMe's approach from any direction. Thresh is armed to the teeth, hatchets and rocket launchers at the ready. Yet just as his foe lumbers into view, Fong's screen flickers and goes motionless. "See that!? See how the screen just froze?" he exclaims. "That's lag. He could be killing me right now, and I can't see it." His screen looks like a paused frame of a video; an icon of a disconnected phone line winks in one corner. Fong is as motionless as his monitor, frozen, cringing, waiting. Even the sounds have ceased. Then: *BOOMBOOMBOOM!* "I just died," he says with disgust, visibly wilting. "I couldn't even move."

He writes off the kill and continues to play, but it isn't long before the screen freezes again - another @#$% lag. Fong curls his fingers and growls, his enthusiasm for the game visibly fading. The delay continues, second after agonizing second. "He sees me just standing there, like an idiot," Fong says biliously. "This is pretty much unplayable."

A light particle takes less than .02 seconds to traverse the country, so much of latency's remaining delays are attributable to other causes - the network server, features running on the game, connection quality, data compression, and error checking on either modem end. Latency can be also partially blamed on narrow bandwidth.

Forrester cites these technological concerns as the greatest challenge to developers. Latency is pervasive and unpredictable, adding an unpleasant, uncontrollable variable to the game. "There's no way to get rid of it," explains Seema Chowdhury, Forrester's analyst, "but there are ways to deal with it." Star-shaped networks require only two routers; others prioritize game data packets. "If a router has 50 packets in its queue, it'll automatically bump a game packet to the top and send it out a little faster," she says.

It all boils down to milliseconds: for turn-based games such as *Scrabble*, 2,000 milliseconds hardly affect the play; racing sims such as *Nascar* or fast-action contests like *Quake* and *Duke Nukem 3D* require much more responsive specs. "One hundred forty to 150 milliseconds is standard, but it's hard to deliver consistently," warns Chowdhury. "Most developers are looking to make games that perform at something like 300 milliseconds. Yeah, you can get 150 a lot of the time, but hit five on a Friday night, and it's not the kind of performance you'll get on your network."

Gaming companies do their best to soothe these inherent and persistent headaches. Boulder, Colorado-based game developer VR-1, which produces titles for Microsoft's Internet Gaming Zone, uses a predictive-motion algorithm technology to minimize the effects of latency. The setup calculates the likely path of vehicles such as planes, tanks, and submarines, then plots them accordingly. The result is smoother and less jerky movements. TEN's Mr. Bandwidth applet, on the other hand, constantly monitors players so games can unfold fairly; Mplayer automatically calculates whether your connection is adequate to handle the requested game. "Green" game rooms mean you're up to scratch; "red" ones indicate your connection is too slow.

"The gaming companies evolved because people want to play against each other, and the Internet is a great way to do that," says Andy Eddy, an incipient online gamer, author, and former *GamePro* editor. "But the problem is that there's so much data to pass."

Designers are tweaking data into smaller packets to speed response time while creating titles - *SubSpace*, *MechWarrior*, *Iron Wolves*, and others - that feature slower-moving environments. Higher bandwidth will cure many of the tech ills, but forecasters say that is too far in the future:

according to Forrester, only 19 percent of wired households will have cable modems by 2001. For their part, gaming companies will have more success focusing on latency concerns than counting on a quick bandwidth fix.

"Latency's a hard issue to solve," Matteucci admits. "It requires that you design software that reduces it, and that you manage the network 24 hours a day to make sure you don't get blockages." To compete in a massive entertainment medium, users have to get consistent performance every time they log on. "You wouldn't watch NBC," he says, "if 30 percent of the time it went blank on you."

Behind Matteucci's analogy lurks the specter of online gaming's greatest competitor – and also its best mentor – television. For all its detractors, TV is America's chosen entertainment medium, and game companies want a piece of it. Rather than passively turn on the tube to watch *Rosie*, why wouldn't John or Jane Q. Public instead want to jump online and play an intelligent and forward-thinking game with real humans?

What gaming has always done, multiplayer gaming can do better: satisfy sociological needs for community and human interaction, provide a realm for our fantasies and a passport for escape.

Fong and his foe serve as harbingers of the future of the Net – and with it the future of technology, ecommerce, artificial environments, networked business, and multiplayer entertainment. Online gaming creates a situation where human nature's every need – for competition, creativity, inspiration, interaction, rewards – gets continually pushed further.

But human history, the PC's future, and the role of the Net aren't particular concerns for Fong – not right now, anyway. He's got CrockMe running blind, dodging jags from his avatar's thunderbolt, zig-zagging a steady stream of bullets. Thresh has accumulated an arsenal for the final minutes of the game, and he unleashes it, raining explosive after explosive down upon his opponent. He throws in rockets and grenades and shotgun shells and a few hundred nails for good measure. It's a virtual World War III, and Fong's monitor becomes a crackling fireworks display of oranges, yellows, and reds.

"Entertainment is the 6,000-pound gorilla in the home," says tech analyst Nick Donatiello. "What's at stake is the future of the personal computer."

"For all the talk of the PC changing the way people get and process information, it's still confined to a minority of owners," argues Odyssey's Donatiello. "Growth in PC penetration is leveling off."

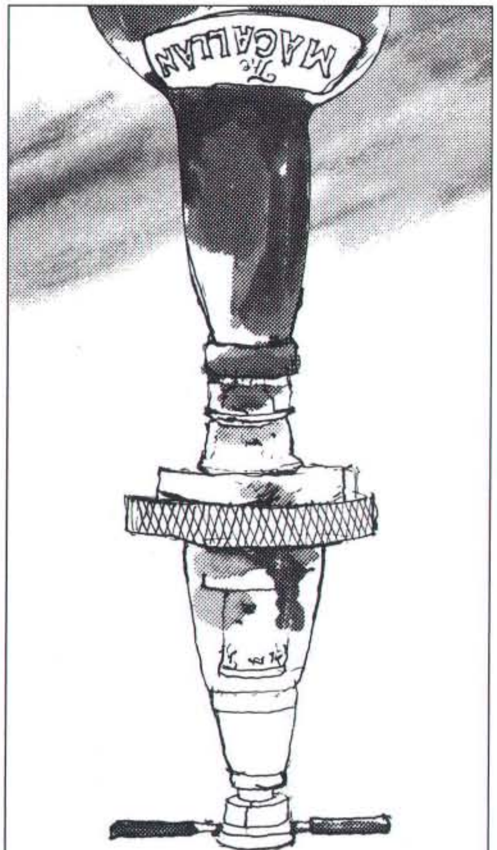
What to do?

Recast the PC as an expansive and flexible entertainment tool, Donatiello suggests, and let games lead the way into the future. "This idea that the Net is going to dominate by providing sports scores or stock prices is really laughable," he explains. "If the Internet doesn't become a viable entertainment medium, it will never be a major force at home. And when we talk about entertainment, we need to talk about gaming."

In the end, CrockMe lies in a widening pool of plasma on the dungeon's steps while Fong takes a breather. Game over. This *Quake* match is done, but Fong and CrockMe know in this quickly changing realm they're destined to meet again – fortified with additional know-how and a fresh, competitive spirit.

And plenty of nails. ■ ■ ■

Colin Berry (colin@wired.com) *edits* Wired's *music section. His* Pocket Tour of Music on the Internet *appears in eight languages.*



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Wireless Gets Real

Simson Garfinkel goes on the road, gets unplugged, and finds out how close we really are to an untethered nirvana.

Illustrations by Lou Beach

Being wired is nothing to brag about. Connected by a copper tether to some wall, today's information networks chain our bodies even as they liberate our minds. Ever try to find a phone jack in a crowded airport, coffee shop, or shady park? To be truly wired, you must be wireless!

Fortunately, the promise of a fully wireless world is close to being realized. Across the US, vast networks of radio antennas are fanning out to seamlessly connect mobile users with existing data networks, in much the same way cell phone systems have. Over the past year, I have experimented with a half-dozen of these systems - in effect taking a historical tour of wireless technology. The systems developed in the 1980s established proprietary services that allowed your laptop to link to a nationwide, albeit patchy, network of radio transmitters. Throughout the 1990s, several strategies evolved: developing more Internet-compatible systems for laptops such as Metricom's Ricochet; pumping up the two-way capabilities of smaller devices, like pagers; or morphing cell phones into data transmitters.

Improved satellite tech and new FCC policies could precipitate affordable ubiquitous wireless service. The spectrum is there. But will we manage to make room for everyone?

All these wireless services, however, still rely on land-based networks. But that's beginning to change. As we move into the future, giant networks of low-Earth-orbit satellites will provide even greater wireless coverage.

First generation: radio networks

Last December, my wife Beth and I took a 5,950-mile road trip from Martha's Vineyard, off the coast of Massachusetts, to Seattle, by way of Texas and California. The goal was simple: get across the country, avoid the winter storms, do some touring, and avoid losing my job. Being a journalist who writes about the Internet, that meant remaining in constant email contact.

The obvious way to stay in touch was to use a cellular telephone and one of those US$300 credit-card-sized cellular modems. (Normal PC card modems don't work over cellular phones - the sound quality is too poor, and calls fade in and out.) But when you are roaming, cell phone connections average $1.40 per minute! Picking up my typical 100 daily email messages would be a $20- to $50-a-day proposition.

Instead, I got two wireless email accounts: the first with Wynd Communications, and the other with RadioMail. Rather than use the cellular phone network, these providers lease time on the nation's two wireless data networks, ARDIS and RAM Mobile Data. Both work with radio modems that plug into a PC-card slot, and both offer nationwide coverage without roaming fees. At least in theory.

Despite being bitter competitors that use different equipment and communications protocols, ARDIS and RAM are virtually indistinguishable. Both are built upon a nationwide network of radio transmitters. Both connect their base stations with leased lines. Both transfer data somewhere between 4.8 Kbps and 19.2 Kbps. And because both combined have spent more than $1 billion over the past decade, neither has yet seen a profit.

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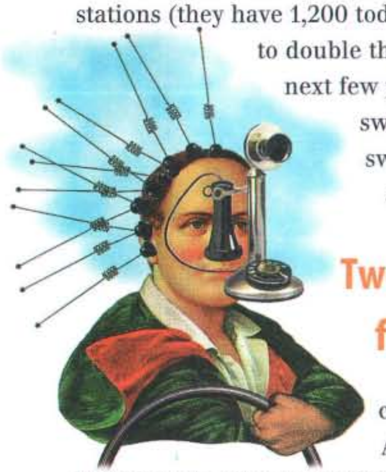
ARDIS was conceived by Motorola and IBM in the early 1980s as a wireless network for IBM's service fleet. An engineer in the field could quickly get assignments, check on parts inventories, and send email. After some early headbanging, in which both Motorola and IBM backed out and then reentered the deal, they created ARDIS in 1990. Today, ARDIS provides service to more than 400 metropolitan areas in the US, claiming to cover more than 90 percent of the business activity and 80 percent of the population; service is also available in Puerto Rico and the Virgin Islands.

RAM Mobile Data, on the other hand, is the child of BellSouth and RAM Broadcasting, a cellular and wireless company. Created in February 1992, the Woodbridge, New Jersey-based company uses a technology called Mobitex, an international standard for two-way wireless data communications. The network consists of base stations (they have 1,200 today and plan to double that over the next few years), local switches, regional switches, and a network control center. ARDIS and RAM largely cater to vertical markets: companies like Pepsi-Cola, Illinois Power & Light, Guaranteed Overnight Delivery, Bank of America, the California Highway Patrol, Holmes Protection. This has kept their growth steady but slow, says Bill Frezza, a freelance analyst who follows the wireless data industry. What eludes both ARDIS and RAM is a killer horizontal application that can link with a company's existing, nonwireless system. For years, many thought email might be that application. The idea is seductive: to pick up your email, just take out your laptop and type Command-M. No worrying about hooking up to a telephone line. But even Frezza, who sits on the board of Wynd Communications, admits that the systems are too difficult to use. The software is nonstandard. The radios are finicky. And the coverage is barely adequate.

I discovered as much during my drive. Even in the middle of a so-called "coverage" area, reception was inconsistent, especially inside buildings. In a New Jersey hotel, for example, my RAM Megahertz All Points radio modem worked if I was sitting at the desk near the window, but not on the bed. In Philadelphia, I could use my Motorola PM100D wireless modem card on one side of an apartment building but not the other. And neither worked in rural areas, where wireless is potentially the most useful. An hour outside Philadelphia, both radios lost contact with their networks. The problem, says ARDIS president Walt Purnell, is too much space and too few customers: "We are just not going to have 100 percent coverage, especially in a country like the US," he said. "It's just not economical."

One solution is to use a satellite communications system as a backup, says Janet L. Boudris, RAM's senior vice president of strategic marketing. But the system requires that customers travel with both a RAM radio modem and a satellite device. And the radio is both heavy and power-hungry - so much so that you can't run it off batteries; you need a power source like an alternator in a truck.



Two-way pagers let you answer without finding a phone, or even leaving your seat.

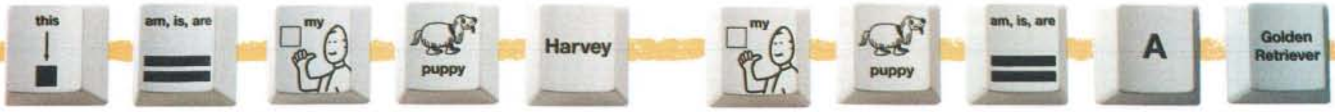
Second generation, part I: shrink it

Second-generation wireless data systems try different approaches. One is to shrink the combo laptop/two-way data radio until it's about the size of an electric razor and can run for weeks on a single rechargeable battery. Put one of these on your belt, and you've got a wearable computer that sends and receives email.

Both ARDIS and RAM now offer a small palm-sized device that has a fliptop lid with a full QWERTY keyboard underneath. The device, called a two-way pager, is manufactured by Research in Motion of Waterloo, Ontario. RIM chair Jim Balsillie says that RAM and ARDIS provide nationwide two-way messaging for about $30 a month. SkyTel, one of the nation's largest paging companies, also offers a similar two-way paging system based on technology called ReFlex 50, which it developed with Motorola.

One of the biggest problems facing traditional pagers is that the network doesn't know where the pagers are and if the pages are received. So every page has to be broadcast throughout the entire coverage area, a technique called "simulcast," but which insiders refer to as "spray and pray." Such retransmitting rapidly consumes the paging system's capacity. Alphanumeric pagers compound the problem because their longer messages require more airtime to send.

Two-way paging, on the other hand, continuously tracks each pager's location. SkyTel's 2-Way pagers contain a tiny 1-watt transmitter that sends a "heartbeat" signal every half-hour or so. SkyTel's computers listen for that heartbeat through special receive-only antennas that are scattered around more than 100 cities nationwide. Each page is transmitted only in the pager's vicinity, and each is acknowledged by the pager itself. This capability harbors a huge potential: "The paging industry is going two-way, whether they know it or not," says Ira Brodsky, president of Datacomm Research in Chicago. The reason? Two-way networks allow a company like SkyTel to offer nationwide one-way paging at about half the price of its competition (starting at $39.95 per month, which includes 600 ten-character message blocks but not rental of the pagers). That's because SkyTel's new one-way pagers are really two-way pagers in disguise. They can't reply to messages, but their built-in transmitter lets the system track them and guarantees that each page is received.



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Beth and I carried SkyTel's 2-Way pagers for nearly three months. Receiving a message is nothing like getting paged - it's more like getting email and being able to send back an instant reply. With the two-way pager, you can answer a message without looking for a phone, interrupting your meeting, even leaving your seat. People can send you a message by email, from SkyTel's Web site, or by calling an 800 number. The message - up to 500 characters - is displayed on the tiny screen. You can then peck out a reply or pick one of the built-in responses. Click Send and you have just completed a two-way communication. There's also a cable that lets you hook up to a laptop or palmtop, in case you want to send longer messages or download pages and archive them to your hard drive.

Rather than "spray and pray" coverage, SkyTel pinpoints each pager's location by tracking its "heartbeat."

Like ARDIS and RAM, SkyTel is plagued by mediocre coverage. There are dropouts in the middle of coverage areas - say, the University of Washington Medical Center in Seattle. Still, SkyTel has signed up more than 68,000 customers for its advanced messaging service - around the same number of subscribers ARDIS and RAM each have after nearly a decade of persistence.

Second generation, part II: faster, cheaper, better coverage

A second wireless strategy focuses on boosting the speed and the quality of services, while continuing to rely on laptop computers. These systems offer dramatically faster data transfer and better urban coverage, but within a limited geographical area.

Here, the only player today is Metricom's Ricochet, whose wireless network depends on spread-spectrum, packet-data technology. The system provides service at speeds up to 28.8 Kbps and speaks standard TCP/IP. Coverage within designated areas is excellent: I've used my Ricochet modem at home, in coffee shops, and even in aircraft (while sitting at the gate, of course). The monthly price is $29.95, plus an additional $15 per month to rent the original radio modem, or $299 to buy. One drawback: right now the system is only available in Seattle, the San Francisco Bay area, and Washington, DC.

Three components make up the Ricochet network. The first is a sleek black radio that looks like a walkie-talkie and carries a battery that lasts about four to six hours. It velcros onto your laptop computer and plugs into a standard RS-232 serial port. Ricochet's network speaks standard PPP, allowing you to use it with any Internet-capable Mac, PC, or palmtop.

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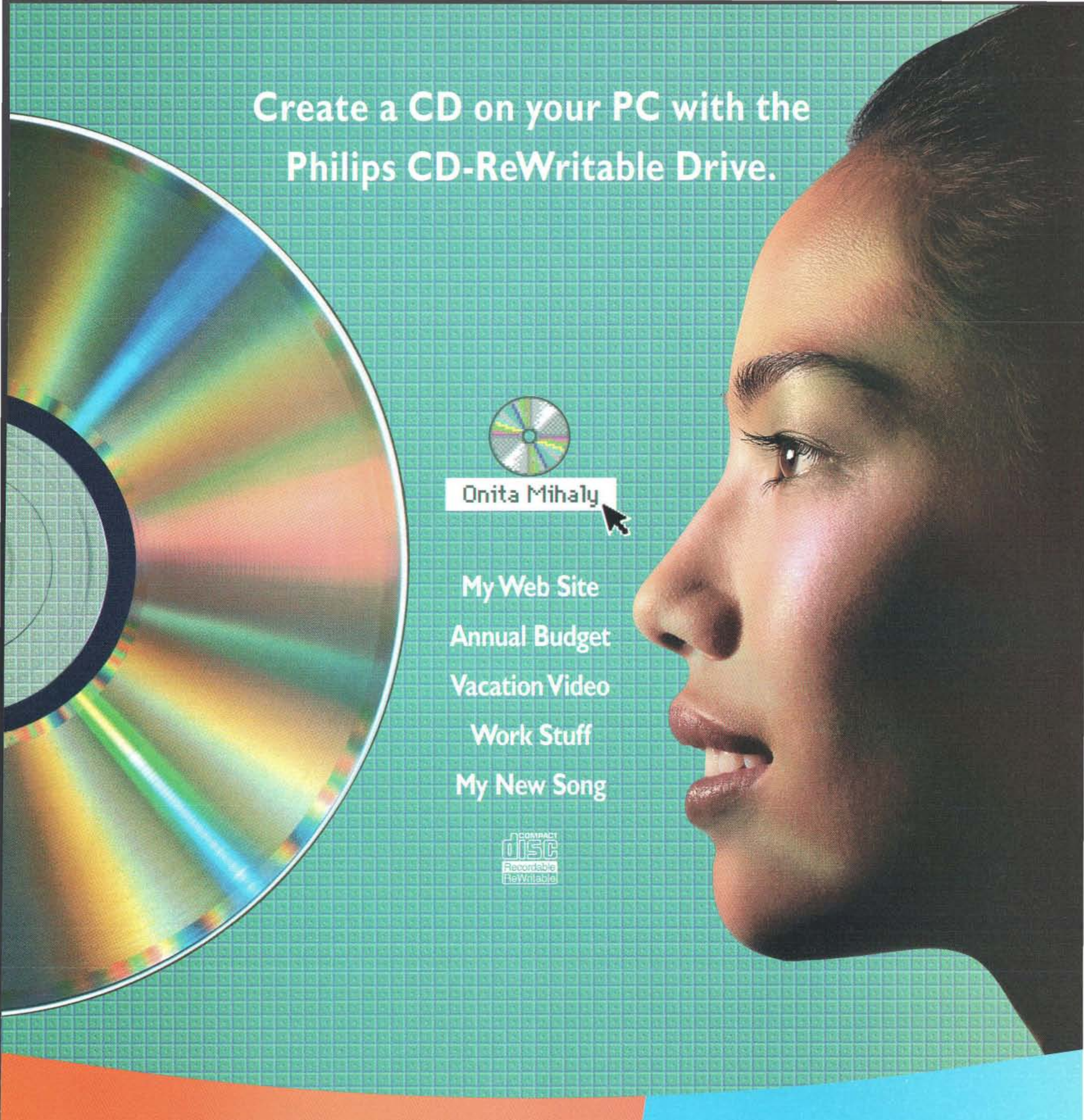
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The second part of the network is a series of radio transceivers deployed in clusters that hang upside down from the tops of utility or light poles. They are arranged in a mesh over the covered area, with roughly one radio every quarter to half mile. These radios are repeaters: they listen for data packets transmitted by modems and rebroadcast them. The third component of the Ricochet network are base stations, which Metricom calls Wired Access Points, typically located atop a tall building. Each contains eight flat-panel antennas and a leased line connecting it to Metricom's frame-relay network.

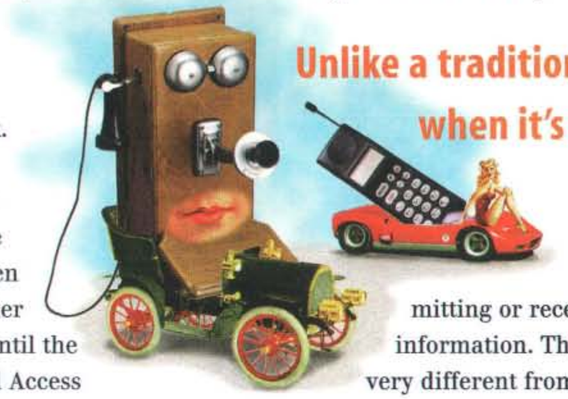
When your computer sends a message, the Ricochet modem transmits the information to the nearest poletop radio, which then relays that information to another and another and then another until the packet reaches the closest Wired Access Point. From there the packets travel over landlines to Metricom's Internet gateway.

Metricom operates within the license-free band of the radio spectrum (902-928 MHz), so it transmits with less than 1 watt of power. That has saved Metricom tens of millions of dollars in license fees. And by passing the packets from poletop to poletop, Metricom saves the cost of bringing a separate leased line to every radio's location. But the flip side is that Metricom spends a lot of time and money hanging the thousands of radios that make up its metropolitan networks.

The Ricochet radios employ a spread-spectrum technique, constantly shifting between 162 different transmission frequencies every 25 milliseconds. "It fires the packet and then hops to another frequency," explains Metricom president Don Wood. As radios within a neighborhood find each other, they follow the same pattern, essentially doing a wireless dance. Metricom's capacity can be boosted simply by hanging more radios. Each poletop radio has a bandwidth of roughly 100 Kbps, Wood says; faster radios are being developed.

Bob Egan, an analyst at the Gartner Group, says that the Ricochet technology has incredible latent potential. "The greatest thing is that some mainstream carrier can align itself with Metricom and get that thing pervasively deployed," he says. "There have got to be a number of local carriers looking at that."

A big advantage of Ricochet is that users can stay continuously linked to the Internet. A "connected" Ricochet radio uses resources only when it's actually transmitting or receiving information. This is very different from a traditional ISP, whose limited number of phone lines can be tied up quickly by continuous connections.



Unlike a traditional ISP, Ricochet is "connected" only when it's actually transmitting or receiving.

One disadvantage, however, is that the radios have so little power that small local variations in topology - a hill or a metal building, for instance - can severely impact reception. When I got my modem, I had lousy coverage at our house, so I called Metricom. A week later, however, service suddenly got better. A few houses away, a new radio had been hung on top of a lamppost.

It's this flexibility that distinguishes Metricom's offering from ARDIS, RAM, and even conventional cellular systems. A typical ARDIS or RAM radio site takes months of planning and costs tens of thousands of dollars to install. Metricom's poletop radios cost $700 apiece and can be installed by one person in five minutes.

Nearly a third of the Ricochet modems are used with desktop systems. Ricochet's price of $45 per month (including modem rental) is strategically placed just below the cost of a second phone line plus an account with an ISP. And the speed is decent: somewhere between that of a 14.4 and a 28.8 modem. In less than a year, the company has grown from 800 to 10,000 customers.

If you limit your travel to Metricom's three geographic areas, Ricochet works well. Indeed, according to Wood, 90 percent of wireless customers aren't traveling from city to city, but within their cities. "The markets are regional," he explains. "ARDIS and RAM are both built around the concept that you are a globetrotter. There are people in that market, but that's only 10 percent of the population or less."

Ricochet may also demonstrate that the wireless future isn't with the old dinosaurs who have been slugging it out for the past decade, but with a new flock of companies. Still, Metricom's having a tough time: while its customer base is growing quickly, the business lost $39 million in 1996. Wood says he's not worried, and expects the San Francisco Bay Area network, at least, to be profitable within a year.

So why hasn't Metricom spread out beyond just three cities? Because the company refuses to license its technology to other service providers. Instead, Metricom has directly approached municipalities and utility companies, trying to cut its own deals for permission to hang its radios from poletops.

Consider Boston. "We'll be happy to build there," says Wood. "But we need the cooperation of the public utility companies and the cities to use their light poles."

That's wrong, counters Frezza. Instead of building the network themselves, Metricom should sell franchisees to locals who will have a vested interest in seeing that the system gets deployed - and intimately know the local power brokers.

This is what the cable industry did, explains Frezza. "All of the limited partners become minimillionaires," he says. "And the national operators eventually bought the system back."

Third generation: cellular to the rescue

Unlike ARDIS and RAM, the nation's cellular phone system (aka advanced mobile phone service, or AMPS) doesn't have a coverage problem. Tens of thousands of those funny-looking three-pronged cellular base stations are scattered throughout the country - beside state highways in Indiana, in the oil fields of Texas, alongside cacti outside Phoenix. And unlike Ricochet, you can buy a cell phone in Chicago and use it anywhere in the United States, as well as in Canada and parts of Mexico.

There are now 30,045 cell sites in the United States, roughly 10 times as many sites as ARDIS and RAM have combined. Somewhere between two-thirds and three-fourths of the country's geographical area is covered, and more than 95 percent of the nation's population is served by wireless phones, according to the Cellular Telecommunications Industry Association. On my cross-country trip, there was just one 30-mile stretch where my cell phone said it was out of range - on Highway 1 in California, just south of Big Sur.

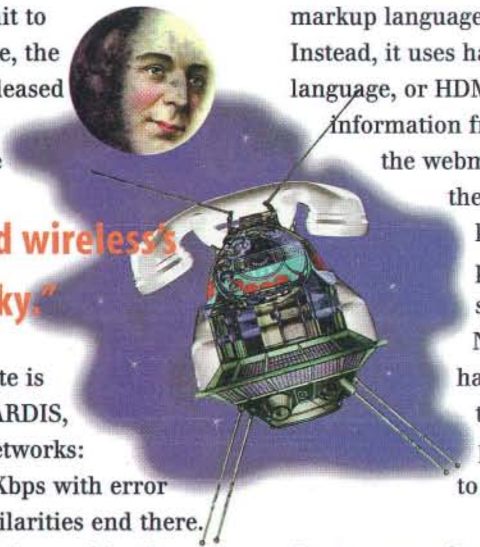
What's funded this coverage are the astonishing fees that people are willing to pay for their mobile phones: 50 cents per minute in some cities, adding up to more than $22 billion a year industry-wide in revenues. It's amazing that people who object to paying more than $29.95 a month for Internet access have no problems shelling out $50 or even $100 a month for their cell phone.

Low-Earth-orbit satellites will greatly expand wireless's reach, some even promise "Internet-in-the-Sky."

If the cellular telephone system is so pervasive, why not use it for sending data? One problem: AMPS is analog. If you want to send bits by air, you've got to first convert them into sound with a modem. But you can't use just any modem, because the cellular sound quality is terrible. Between the poor fidelity, the bursts of noise, and the cell-to-cell handoffs, it's hard to get a decent signal. Still, data services represent an enormous potential market. So cellular phone companies are exploring two approaches to putting data on their networks.

One idea is to ditch the AMPS system entirely and go with a pure digital system - the same technology used for the next generation of digital telephones. Companies building all-digital cell phone networks plan to treat data as if it is voice, sending it along as just another stream of bits. Qualcomm, a San Diego-based manufacturer of digital cellular telephones, has even put a cable connector on its new line of digital phones that lets you connect to a standard laptop. To the computer, the phone looks like a 14.4 modem; faster speeds are possible. This digital wireless phone network, however, has a long way to go to equal the analog one that's already running.

Another idea is to retrofit existing AMPS systems with a technology called cellular digital packet data. Like the other wireless data networks, CDPD breaks information down into packets which are transmitted from a handheld unit to a base station. There, the packet travels over leased telephone lines to a network center. The over-the-air data rate is also similar to the ARDIS, RAM, and SkyTel networks: roughly 9.6 to 14.4 Kbps with error correction. The similarities end there. Unlike the technologies used by the other systems, CDPD is based on the same TCP/IP as the Internet, making such systems friendly to Web browsers and email.



AT&T Wireless and Bell Atlantic Nynex Mobile are two big proponents of CDPD. Instead of the bulky laptop, AT&T wants the cellular telephone to become the day-to-day information appliance, letting people get news headlines, directions to a restaurant, or the name of a nearby hotel. Shipping companies could use these next-generation cell phones to route their trucks, and executives could scan the messages waiting in their electronic mailbox.

AT&T Wireless sells this service today - it's called PocketNet, and it's based around a CDPD-compatible phone manufactured by PCSI. The phone, which I tried for a few weeks, has a built-in Web browser and can send and receive email. My biggest problem was battery life: I got roughly four hours of "talk" time on AT&T's CDPD network. Another serious problem with the PCSI phone was its interface. PocketNet runs software developed by Unwired Planet, a Redwood Shores, California-based software start-up that's funded by some big names in the cellular industry. Ironically, despite the fact that PocketNet has four times as many buttons as my two-way pager, it was harder to use to peck out email messages.

But what frustrated me most about the CDPD telephone was the built-in "Web browser." It doesn't speak the hypertext markup language used by every Web site. Instead, it uses handheld-device markup language, or HDML. If you want to access information from a particular Web site, the webmaster has to download the HDML developers' toolkit and then create Web pages and services that speak the new language. Not surprisingly, only a handful of sites have done that. The Net and the phone have a lot of work to do on their relationship.

Next generation: satellites

In the coming year, expect to see wireless networks and services competing as never before. Part of this will result from ongoing attempts to balance the federal budget. In the past few years, the FCC has raised billions of dollars by auctioning spectrum for so-called personal communications services, such as digital cellular telephones. Throughout the 1990s there was a choice of only two different cell phone vendors within each market - soon there will be as many as seven.

At the same time, several companies will launch constellations of low-Earth-orbit satellites, or LEOs, that will greatly expand the reach of wireless. Unlike geostationary satellites that hover more than 22,000 miles above the earth, these satellites will orbit only a few hundred miles up.

Orbcomm is one system that should be fully operational early in 1998, allowing two-way paging and wireless email anywhere on the planet. But the service will not come cheap: Orbcomm might cost as much as a penny per character sent, says Don Meyer, a spokesperson for Magellan Systems, which has designed a handheld unit that can send and receive messages via Orbcomm.

Eventually we will discover that there is more spectrum than there are people to fill it – if it's efficiently managed.

Teledesic is another LEO system that promises "Internet-in-the-Sky" service, giving businesses anywhere on the planet a 2-Mbps connection to the Internet. To do that, Teledesic has to give up some degree of mobility: the receiver requires an antenna about 18 inches across and a clear view of the sky. That's a problem for handheld devices.

The bottom line: In just a few years, the combination of cheap radios that can transmit and receive at high frequencies, the further development of satellite communications, and new FCC policies will open the door to high-speed, ubiquitous, wireless data communications.

Many businesses are already discovering that it's cheaper to install point-to-point radio links than pay the local phone company for a high-speed leased line. As portable radios are developed to transmit at higher frequencies, there will be increasing amounts of spectrum available for general use. Eventually we will discover that there is more spectrum than there are people to fill it - especially if that spectrum is efficiently managed.

Meanwhile, wireless coverage will get consistently better because of new technology that uses the same network for both data and voice. If ARDIS and RAM had teamed with the cellular telephone industry, instead of building their own orthogonal data networks, they would have excellent nationwide coverage today throughout both rural and urban America. And if the cellular industry had built in data capabilities from the very beginning, they would be reaping even higher profits today. They didn't. Now someone else will. ■ ■ ■

Simson Garfinkel (simsong@vineyard.net) *is a contributing writer to* Wired.

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The Need for Speed

There's a little bit of supersonic car in all of us.

By Dean Kuipers

Digital technology allows us to live much faster in our minds than we can in our bodies. But the quest for the World Unlimited Land Speed Record brings it all back down to Earth.

Immortality is what they want, and they can see it out there, flickering in a salt-flat mirage. It's the kind of immortality accorded to men who have walked on the Moon – the rare few who have undone mythology by undoing the distance from here to there. It is the kind of immortality that comes fixed to a machine.

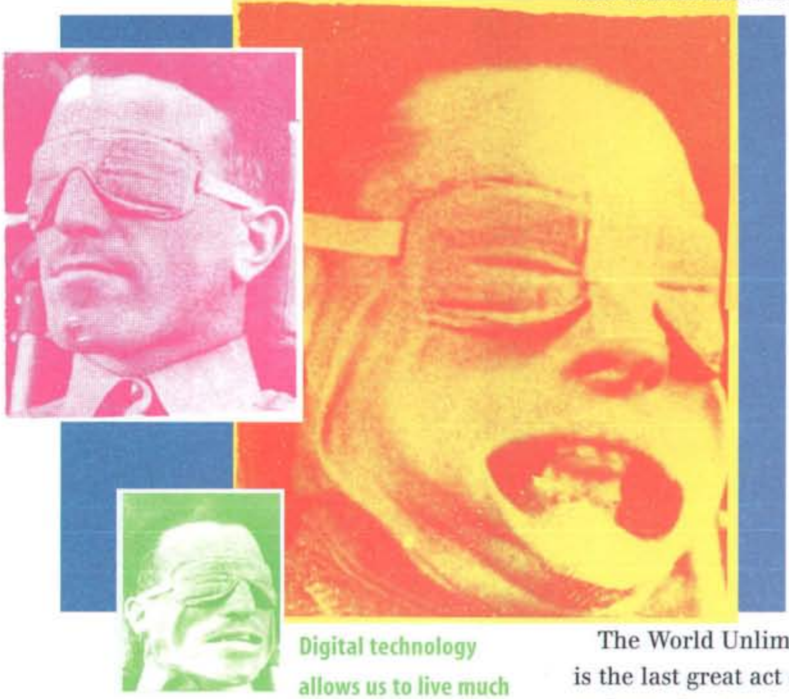

PHOTO: UPI/CORBIS-BETTMANN

Craig Breedlove saw it shining on the desert in October 1996 as his *Spirit of America* jet car flipped on its side at 675 mph – a speed no other human has ever experienced on land. But Breedlove saw it change into a more fearsome unknown, his own mortality, as the mud lake surface of Nevada's Black Rock Desert scraped by just inches from his head.

The World Unlimited Land Speed Record is the last great act of hot rod culture – and perhaps the American Dream. It is a quest to build a freedom machine in your garage and hightail it over the horizon as fast as possible just to see what no human has ever seen, and so become the eyes of the entire species. The fastest are remembered forever in the record books.

Immortality is what they want, but it is the mortality of the World Unlimited Land Speed Record that makes us care. Raw speed and this act of perceiving what no one has perceived shoves these racers very squarely back into their bodies and very literally down to Earth, where the clock ticks out milliseconds as loud as a pile driver. That's what enables the rest of us to identify with their desire – cheating time and space is what most of us do for a living.

Although his damaged vehicle was unable to run the requisite second trial, Breedlove's failed world record attempt was the first time in 13 years that anyone had threatened the still-current record of 633.470 mph set by Britain's Richard Noble in his *Thrust 2* in 1983. Breedlove, who turned 60 this year, has held the record five times. He was the first man through 400 mph (1963), 500 mph (1964), and 600 mph (1965). (See "The Fast American Hero," *Wired* 4.11, page 184.) Now, he's hoping to punch through the sound barrier. Meanwhile, Rosco McGlashan will try to put his *Aussie Invader III* past 700 mph on Lake Gairdner in remote Western Australia. In early September, British RAF pilot Andy Green will drive Noble's new glossy black monster, *ThrustSSC*, during a head-to-head showdown with Breedlove in the Nevada desert. *ThrustSSC* is believed capable of 850 mph.

Breedlove and Noble say they will not only break 700 mph, but will also hammer through the speed of sound at 765 mph – a feat no person has accomplished on the ground. No one knows what happens when a car pierces the barrier. Shock waves may lift the car and throw it like a child's toy. But no matter what happens, we'll be watching. We'll all be watching because we understand intuitively that these men commuting toward Mach 1 are taking part in something we do less and less often in our speed-obsessed culture – perfecting the way we move physically, rather than virtually.

"If I could describe being the head of a bird, and the car as an extension of your

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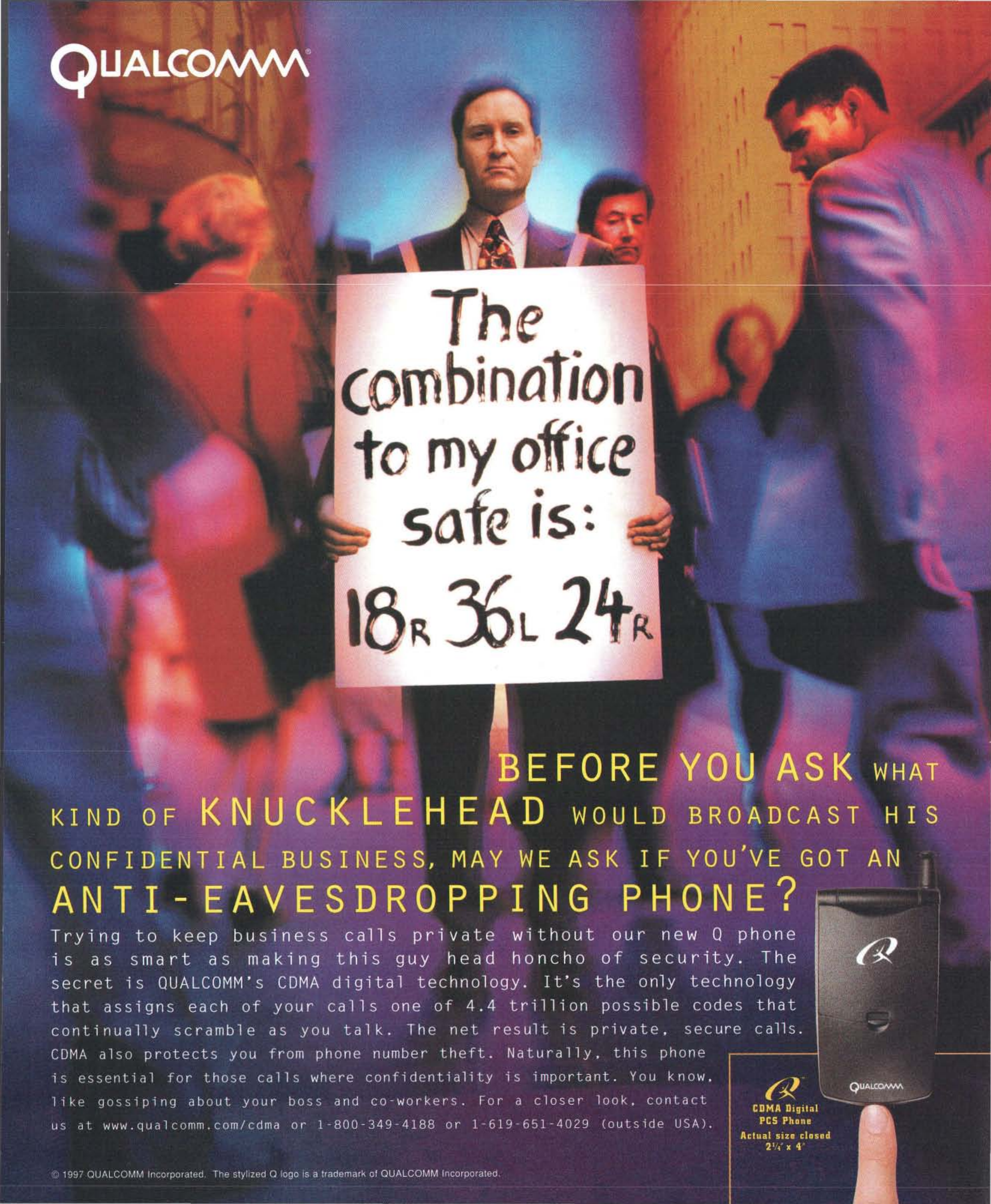
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being, you'd be like the brain inside of the bird because you are part of the vehicle," says Breedlove, sitting in the shade of his garage compound in the quiet Sacramento Delta town of Rio Vista, California. The lazy breeze smells of rust, carbon graphite, and the fat Sacramento River. "Through the input that comes through the steering wheel, through your back, and through the sensory input you get inside the cockpit, the vehicle becomes an extension of yourself, and you operate it from that level. You are the guidance. You are so integrated with the hardware, it's like there's an absolute synergy between man and machine. Pilots experience that, too. They become like the head of a bird. They feel the wing tips as if they're up there flying with feathers."

Such stony, Gibsonesque ruminations on the man-machine interface are part of our fascination with what Noble calls this "new era" of speed machines. We yearn to fly. We ache to visit space. We play computer games that deliver the visual sensation of being the ghost in the machine.

But Breedlove has his ass firmly planted in a real machine. He has no safety net, no Off switch, and no virtual death. His speed act is both mortal and immortal. Roaring jet cars mimic communications technology by removing us from the body's limitations. And yet, they really do hurl the body through space using one of our most familiar technologies - the car. Noble, talking from *Thrust* headquarters in an old hangar at the sprawling former Royal Air Force base at Farnborough, England, has noticed this paradox. "*Thrust 2* was probably one of the most stable and best land speed cars of all," he chuckles in his no-bullshit British clip. "It went over 600 miles per hour 11 times. It got so reliable that it was our 600-mile-an-hour taxi. Seriously. That's what you've got to do with them, of course. You've got to keep making them more and more reliable until eventually you get to a point where 600, 650, 700 miles per hour is just commonplace."

The technological feat of a land speed record is matched by a purely human act of mind expansion. As guys like Noble learn to drive a car at 600-plus mph across sun-baked playas all over the world, they hone their ability to control the vehicle by reconfiguring their sense of time. "It's very interesting," Noble adds. "When I was driving (the land speed record car), I was driving on a very regular basis. What happens is that your mental processes speed right up, just like when you're about to have an auto crash. Everything happens in very, very slow motion. You're actually holding the wheel between finger and thumb - it's a very delicate sort of thing. There is plenty of time for everything. It's very relaxing. On the last record attempt, I was actually hammering the side of the car, saying, 'Get on with it! Hurry up!' 34,000 horsepower, ya know? I suppose I'd gotten to a stage of development where I was ahead of the car."

Being ahead of the car may be humanity's fatal flaw. We travel, communicate, and even live so much faster in our minds than we can in our bodies. But that is less true if you happen to be driving a land speed record car, where speed is registered by real dirt moving beneath your wheels, and control has perfectly correlating consequences. For the rest of us, the battle is perceptual. Unconsciously or not, we want our bodies and senses to respond as quickly as our brains move and process information. This modern version of the classic mind/body split fuels "the need for speed" and helps explain the quest for the World Unlimited Land Speed Record.

As cyberspace reconfigures our sense of time, we want our bodies and senses to respond as quickly as our brains process information.

Some top conceptual thinkers entertained this possibility in November 1996 at the fourth annual Doors of Perception conference - a popular Netherlands-based confab ruminating on sticky new media subjects. The subject was "Speed." The presentations, given by more than 40 speakers, ranging from architect Rem Koolhaas to environmental guru Wolfgang Sachs to film archivist Rick Prelinger, coalesced around two main points: first, that the vectors of technology and natural resources are out of sync and diverging, leading to an industrial ethic that designs and markets products much faster than natural resources can actually be grown, mined, or recycled; and second, that this is also happening on a personal level, as our rapidly changing, media-oriented lives diminish the physical reality of our bodies.

Despite the apocalyptic overtones, the Speed conference posed one of the most important questions of our age: as we trill across the structures of cyberspace, what happens to this bag of bones we drag around attached to our heads?

"For the modern mind, space and time are the basic forms of hindrance," said Sachs, a member of the Wuppertal Institute environmental think tank, in his address. "Anything that is away is too far away. The fact that places are separated by distances is seen as a bother. And anything that lasts, lasts simply too long. The fact that activities require time is seen as a waste. As a consequence, a continuous battle is waged against the constraints of space and time; acceleration is therefore the imperative which rules technological innovation as well as the little gestures of everyday life."

Craig Breedlove is no stranger to such heightened high-speed perception. Film critic Hollis Frampton describes a dramatic 1965 Breedlove crash in his book *Circles of Confusion*. At 620 mph, Breedlove's *Spirit of America* went out of control, sheared off a few phone poles, sailed airborne and upside down, and landed in a salt pond. Breedlove emerged unscathed. Frampton writes: "He was interviewed immediately after the wreck. I've heard the tape. It lasts

Alli Truch

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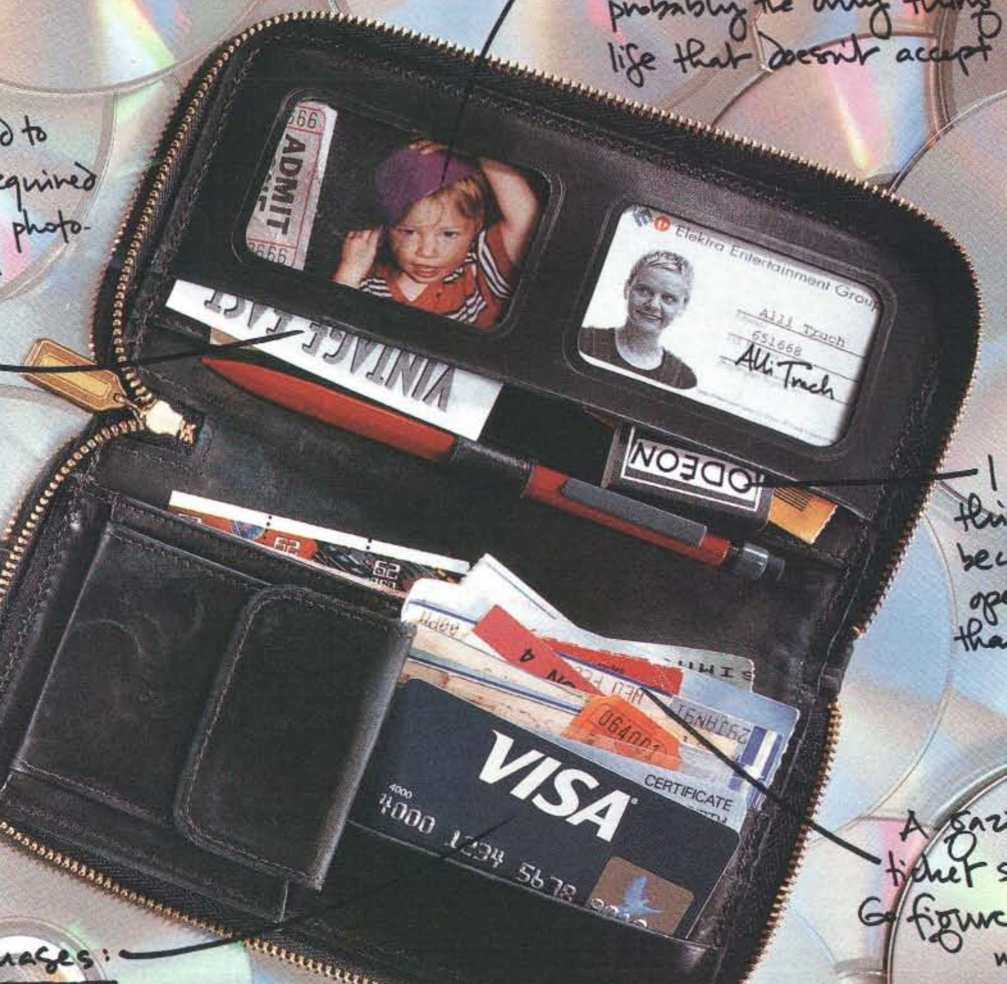

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an hour and 35 minutes, during which time Breedlove delivers a connected account of what he thought and did during a period of some 8.7 seconds. His narrative amounts to about 9,500 words. Compared to the historic interval he refers to, his ecstatic utterance represents, according to my calculation, a temporal expansion in the ratio of some 655 to 1."

Ultimately, the details of what Breedlove said in that hour and a half are less important than the fact that there were details at all - and not just an adrenalin-flavored blur of terror. "It's amazing how much information you actually pull in and how much you can pull back," says Breedlove. "It's the kind of thing where you can have your attention interrupted for just an instant and miss some type of data input, a marker or location - at the speed that the vehicle's going, that could be a fatal mistake."

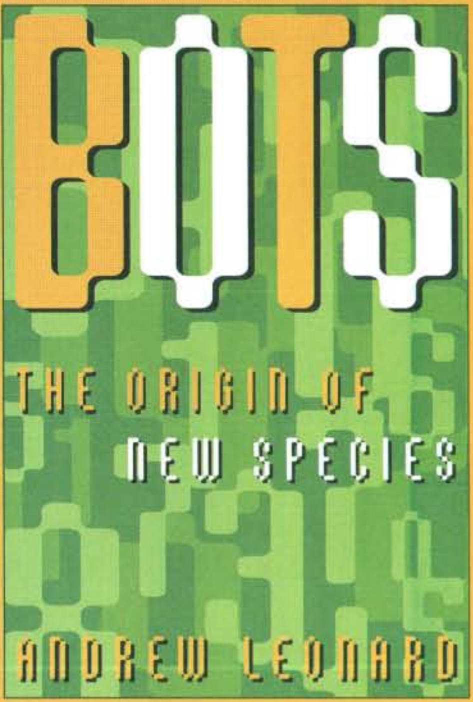
What makes the land speed record particularly terrifying, of course, is the closeness of the rushing earth, connecting that speed to the real distances traveled by the human body. In an age when whole libraries – or even whole economies – spurt back and forth across the globe as instantaneous electronic information, it may make absolutely perfect sense to blast through space in a jet car for no other reason than to see how fast it can go.

In an age when whole economies spurt across the globe instantaneously, it makes sense to blast through space in a jet car just to see how fast it goes.

"Since the inception of the automobile, there's been a world speed record," Breedlove says. "It's like the heavyweight champion of motor sports - it's a simple concept that people relate to and understand. It has to have four wheels, and they have to touch the ground, and you have to do the record within an hour time limit, and it is a two-way average, so you have to do it twice - but other than that, it's just the fastest car in the world."

The aesthetic of the land speed record competition is strictly Run What Ya Brung, and it remains an exercise in technological improvisation. From a design standpoint, anything goes. Noble's *ThrustSSC*, for example, uses two Rolls-Royce Spey 202 turbojet engines normally used in the RAF's Phantom fighter jet. The car sucks aviation fuel at 5.06 US gallons per second and generates about 50,000 pounds of thrust at a rough maximum of 110,000 horsepower. (Noble points out that this equals about 1,000 Ford Escorts or 145 Formula One racing cars.) The car's driver, Andy Green, sits between the tubular engines, steering by the rear wheels. On June 4, during a test run in Jordan, this car reached a peak acceleration of 1.2 g and a top speed of 540 mph (869.022 kph). At 10 tons, *ThrustSSC* is extremely heavy, and it is designed for high downforce. In short, Noble hopes his car will power through the sound barrier like a jet-powered brick.

The *Spirit of America*, on the other hand, is supposed to skip through it like a hurled stone. Breedlove's car runs a single Modified J79 GE-8D-11B-17 jet engine from a US Navy F-4 Phantom fighter. This engine puts out 22,650 pounds of thrust and 45,200 horsepower with afterburner and water injection. It burns plain ol' Shell 92-octane premium gasoline. Breedlove drives the car himself, crammed into a cockpit 20 inches wide and 5 feet long at the nose of the 44-foot craft. The downforce is calibrated to be the minimum necessary. Fully loaded with fuel, the *Spirit of America* weighs 9,000 pounds - less than half the *Thrust*'s weight. Breedlove's 675-mph skid last year was caused by transonic instability generated while slicing though a crosswind. This year, Breedlove hopes he's cured the aerodynamic inequities so that the car will be



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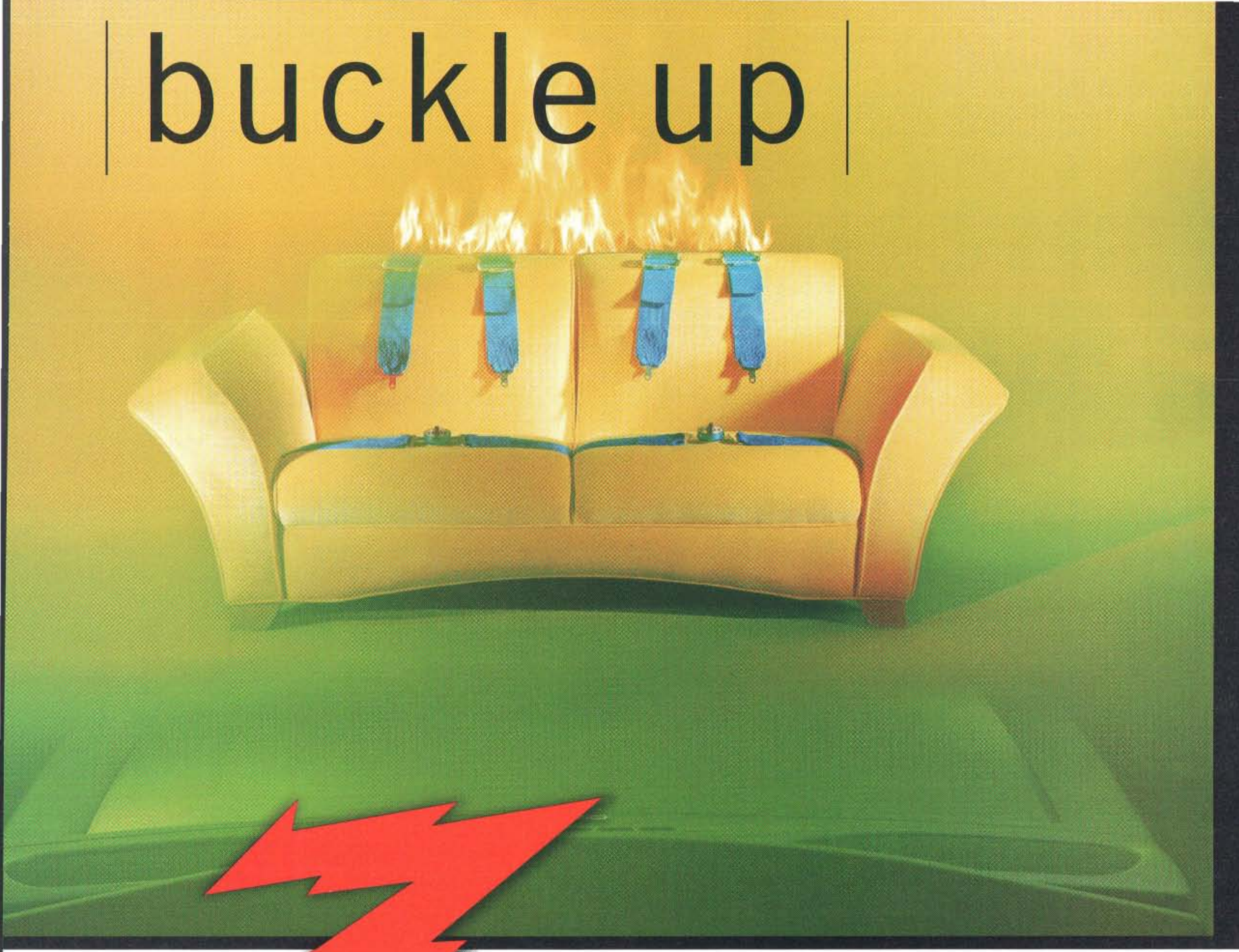

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able to weather shock with more stability as it slips through the sound barrier.

Their major challenger is Rosco McGlashan, whose *Aussie Invader III* is also a light, single-engine design, running a SNECMA 9K-50 turbojet engine that kicks out 36,000 horsepower using AMPOL Jet A1 fuel. McGlashan drives it, sitting off to the side of the huge engine, near the car's midline. His last car, *Aussie Invader II*, claimed the Australian land speed record at 802.613 kph (approximately 498 mph). *Invader III* is similar, though it has been shortened by 3 feet to alleviate downdraft problems that caused its predecessor to plow its nose through the salt. Both Breedlove and Noble believe that McGlashan's car is easily capable of 700 mph, but they have doubts about 765. McGlashan insists, however, that it's been designed for well over Mach 1.

These are the specs - the solid stuff a guy can trust. To deal with the intangibles of the interface, Breedlove has worked with sports psychologist Marty Greenberg of the University of California at Davis to help him learn to trust his pile of nuts and bolts. Noble and McGlashan say that the love of their team assures them that their cars have been put together right. Noble says soberly, "If you trust the team, then of course you trust the car. There's no way that you can check a thing like this out absolutely, every nut and bolt. It's like trying to ask Neil Armstrong to check out his *Saturn V* before he goes out. You can't do that."

These drivers want a line in the record books, yes, but it's more than that. They want to win the race against time and taste immortality. But there's a dizzying irony in chasing down immortality by driving a land speed record car: the faster you go, the more mortal you become.

There's a dizzying irony in chasing immortality by driving a land speed record car: the faster you go, the more mortal you become.

Even if the World Unlimited Land Speed Record approached the speed of light, in the end it would still be a race against time. The record itself is only made meaningful by the clock. Yet as William S. Burroughs pointed out, the clock is an agent of mortality. "The One God is Time," he writes. "And in Time, any being that is spontaneous and alive will wither and die like an old joke." But Burroughs also devised a solution to this problem, suggesting that we step "from Time into Space."

Immortality will require a technology that trades time for space. It will require a vehicle that can travel light-years, and suspension methods to slow or reverse the effects of time on the body. Teleportation. Time travel. The kind of devices that will probably be invented by obsessive speed freaks who long to build a freedom machine right there in the garage. People like Craig Breedlove, Richard Noble, or Rosco McGlashan.

"I really believe that all three of them were put on this world for a purpose," says McGlashan's wife, Cheryl. "Ross was put on this world to be the fastest man in the world. He started off with a V-8 bike and a rocket motor bike and a rocket go-cart, and he's always had that - as you say, 'the need for speed' - in him. Everyone has their job in a different area - an accountant is a very good accountant. Well, Ross is a very good driver when it comes to handling speed. He never gets fazed, never panics; he's just at home sitting in a race car. I'm sure he was put on this world just to be the fastest man in the world."

Maybe you ought to just get out in your car and drive. ■ ■ ■

Dean Kuipers (jackalop@gte.net) *is managing editor of* Ray Gun.

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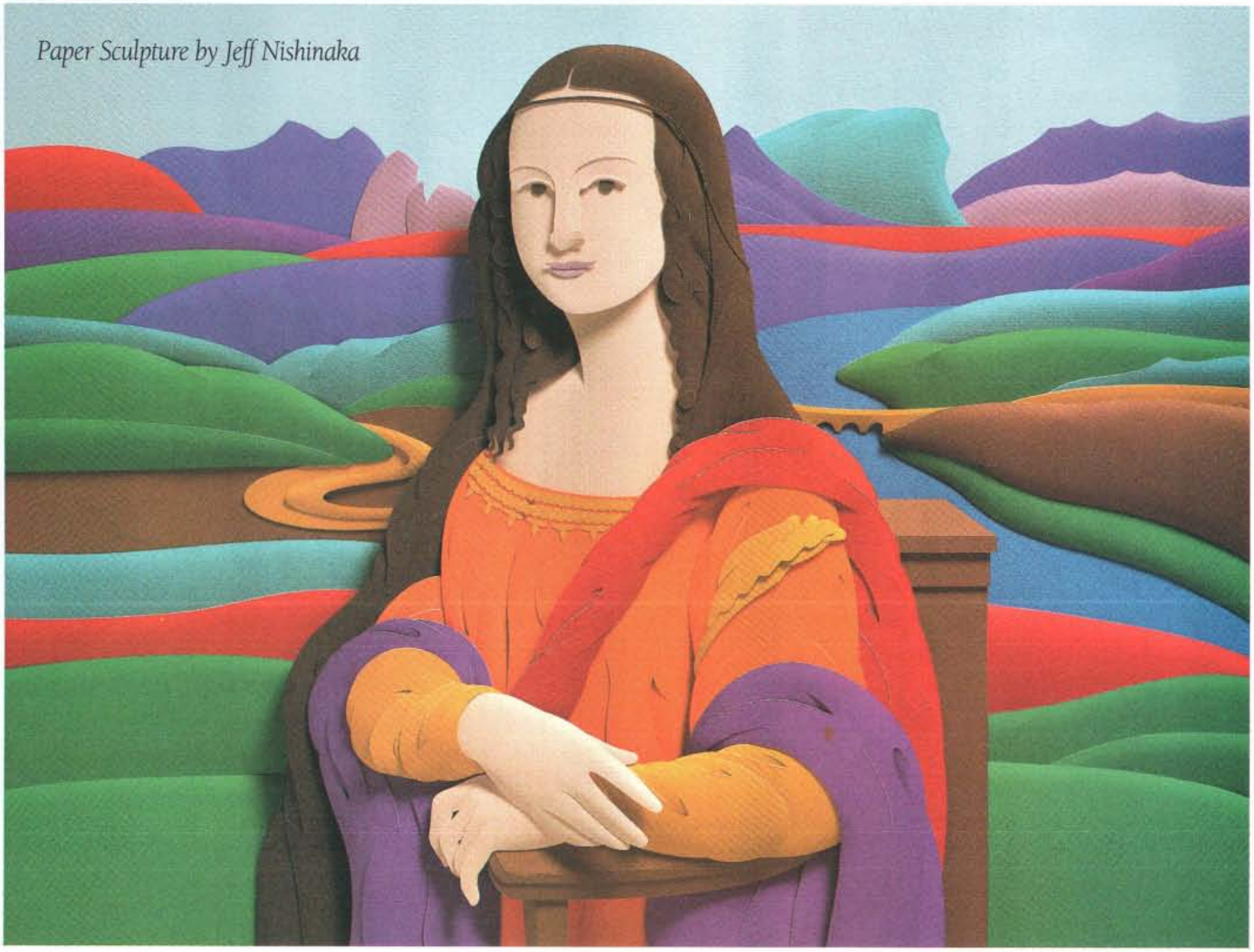

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(Re)placing the City of Bricks

By Thomas J. Campanella

Digital technology – the Internet in particular – is often accused of contributing to the deterioration of place. It has been construed as the antithesis of the carbon-based world our grandparents paved, knitted, and nailed together with sex and sweaty palms. The networked computer, meanwhile, creates an alluring "mirror world" with many of the features and few of the dangers of downtown. This online metropolis, it is feared, this city of bits, will render the city of bricks obsolete.

Cyberspace is, of course, an ethereal realm, one floating above the millennia-old tangles of geography and place. This is hardly surprising, given that the Internet began as the ultimate antispatial exercise, conceived to be everywhere and nowhere at once. This placelessness has encouraged some dire predictions about the fate of the city. From a purely practical standpoint, we don't really need the city anymore – many of the chores of daily urban life can be handled from a stream bank in Vermont. Digital technology appears to challenge the raison d'être of urbanism.

"Difference is all the mind's input devices can detect, and difference is in a sense all the mind is there to consider and respond to."
– *Gregory Bateson*

This has particular appeal in the United States, historically an anti-urban nation, and one that has long sought respite in a "middle landscape" equidistant from both the city and the wilderness. What the streetcar and the automobile initially delivered – a suburban life in a manicured pastoral setting – the modem and motherboard have made productive. Now, in theory at least, the middle landscape is no longer an inert bedroom refuge, a place to retire at dusk; it can be the setting for a life both close to nature yet fully engaged with the world of affairs and ideas that for centuries only the city could provide. Our digital "instruments of instant artificial adjacency," as Michael Sorkin has called them, give fresh meaning to Leo Marx's classic dialectic of the "machine in the garden."

Remote Control

Digital Merce, *by Nam June Paik. Courtesy of SFMOMA.*

Savvy marketers have been quick to capitalize on this quest for a mythic pastoral. A Packard Bell ad campaign, for example, begins in an urban apocalypse worthy of Fritz Lang, the modern metropolis as unrepentant hell. Aging patrons shuffle in resignation through a gloomy banking hall; Nazi-like guards patrol the public library; a child hides behind an ancient edition of *Paradise Lost*. Suddenly, the camera sweeps skyward past skull-studded parapets and off to a fresh green landscape. The clouds break, and the sun shines brightly on a single-family home surrounded by rolling hills and a picket fence. The voice-over chirps: "Wouldn't you rather be at home?"

Taken to an extreme, the combination of digital technology and fear of the urban environment can lead to the creation of a fractious, bifurcated society. When all the knowledge workers telecommute, who is left to tend the city? Those with the education and means to flee urban "evils" will do so, while the others will be forced to remain. Poverty of information will further alienate the marginalized, while the cog-

Don't Blame the Tools

By Mike Godwin

There is a middle ground in the discussion of filters that goes largely unnoticed in the sloganeering and handwaving about "privatized censorship," on the one side, and "user empowerment," on the other. Increasingly, we will all be using filtering systems simply to manage the load of information we face. And these technologies *will be used by some governments to censor*. Consider: personal computers make it easier for governments to engage in oppression, too. But we never oppose PCs for this reason. Human beings, not their tools, bear responsibility for censorship.

This is not a defense of filters. It is instead a plea that we cease making enemies of our natural allies. Our divisiveness is something the censors use against us. Hate the censors, not the technologies.

Mike Godwin (mnemonic@well.com) *is staff counsel at the Electronic Frontier Foundation.*

"You can't escape who you are."
– *Douglas Rushkoff*

nitive élite build themselves a virtual metropolis, a world perhaps like the apartheid burbclaves in Neal Stephenson's *Snow Crash*.

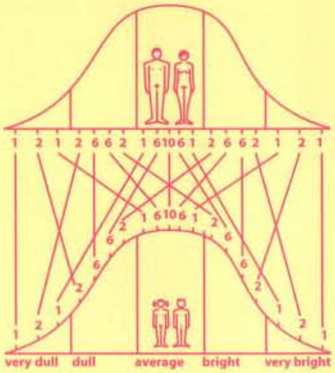
This radical view, however, is highly unlikely. Most evidence suggests that the city has prospered in the digital age – from the proliferation of districts such as Silicon Alley and Multimedia Gulch, to the popularity of webcams and sites like CitySearch, to the robust economy, due in large measure to the infotech industry. Rather than wash away its purpose and vitality, the bitstream has given new life to the city of bricks.

In the future, cities will likely play even more strategic roles. Metropolitan centers like New York, Hong Kong, and Tokyo are the pulse points of the global information economy; any increase in volume and intensity will add immeasurably to their power and influence. Admittedly, there are costs associated with maintaining a physical presence in the city; many institutions will find it increasingly difficult to justify the expense when the products and services they offer are digital. But the "economy of presence," as Bill Mitchell and Oliver Strimpel described it, works both ways; there are real, tangible values to being there. The placeness of the city can never be replicated.

Thomas J. Campanella (tomcamp@mit.edu) *is a PhD candidate at MIT's School of Architecture and Planning.*

"Be careful whose advice you buy, but be patient with those who supply it."
– "Kurt Vonnegut"

Baby Bell Curve



Genetic determinism does not mean that we are condemned to a caste system, with the children of dull parents always dull, and those of bright parents always bright.... Regression to the mean assures social mobility ...

From "The Future of Psychology," by Hans J. Eysenck, in **Mind and Brain Sciences in the 21st Century.** *Reprinted by permission of MIT Press.*

Captive Audience

By Kalí Tal

Deregulation has delivered a vast array of telecommunications products to American consumers, and with long distance giants scrambling for a piece of the local action, the telcos promise that phone service will only get better – and cheaper. Is this a great time, or what? :-)

Certainly for MCI, which exploited bargain-priced customized calling circles to carve out its share of the cutthroat telecom market. Indeed, competition has been the basis of the company's success. Which is why MCI threw the book at David T. Moore when he tried to switch long distance carriers.

"When machines and computers, profit motives and property rights are considered more important than people, the giant triplets of racism, materialism, and militarism are incapable of being conquered."
– Martin Luther King Jr.

Moore, as it happens, was already behind bars. Rather than pay the US$3 charge routinely added to inmates' collect calls, he allegedly hacked the prison's automated call-routing service. Contacting an outside operator through other customers' voicemail systems, Moore managed to elude MCI's Maximum Security technology to reach out and touch his loved ones in northern Virginia.

Though the accused was not convicted in November for his unauthorized Friends & Family discount, the case calls attention to the telecon-omy inside America's prisons. The ultimate captive market, correctional institutions have become collectional systems, since inmate callers pay both their debt to society and a surcharge to companies like MCI, which reportedly controls 50 percent of the state prison market nationwide.

What was once called a bastard business has become a billion-dollar industry thanks to the convergence of two trends: telecom competition

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"For better or worse we are destined to live in a world devoted to modern science … What is the sane attitude of a scientist or layman? Absence of wishful thinking. No emulation of the ostrich."
– *Vannevar Bush*

and the prison population boom. Restrictive telephone privileges, conceived to curb crime and harassing calls as well as to manage inmate behavior, have spurred the telcos to come up with intelligent service platforms like Maximum Security or BellSouth's Meridian MAX. They have also provoked a bare-knuckles battle for the exclusive prison pay phone contracts that produce revenues five times higher than the average booth on the outside. Niche providers, meanwhile, have also caught high tech fever, moving beyond the manufacture of products like ICC's indestructible pay phone to biometric systems such as T-Netix's SpeakEZ VoicePrint.

The jailers, for their part, have made out like bandits. Along with substantial signing bonuses – in California, for example, MCI and GTI installed all the necessary equipment in 32 state prisons for free – correctional facilities receive large commissions when they seal the deal. Florida, already raking in $10 million from its pact with MCI, in early 1997 also hired Sprint to handle the phones in 53 prisons, collecting a 57.5 percent commission on each call.

Though these new technologies have created major profits for the telcos, part of the price tag, of course, has been passed along to consumers – diffused for the general population, in concentrated form for the incarcerated. In fact, prison-originated phone calls cost far more than other calls: prisoners are required to call collect, then the telcos tack on surcharges, lengthen calls with recorded interruptions stating that the call comes from a correctional facility, and routinely cut off calls – forcing inmates to redial and pay an additional surcharge. Groups like Virginia-based CURE have lobbied to remove this punitive pricing structure, but the state of Virginia has put such efforts on hold – perhaps because in 1995 its commissions rose from 28 percent to 50 percent.

Prisoners aren't the only ones paying the price. In 1996, San Antonio-based North American Intelecom promised to refund $400,000 overcharged to those who accepted inmates' collect calls. In January, MCI agreed to repay $1.5 million in such overcharges to Floridians. Clock advancement, or rounding up to the next minute, and added "plus-plus" charges disguised by clock advancement are not uncommon, says Arnold Erickson, a staff attorney at the Prison Law Office of California.

America's penitentiaries have indeed become profit pens, but the tools of the trade are no longer confined to correctional facilities. Intelligent call center services have a growing foothold in government and corporate markets, both to cut costs and protect against telecom fraud. Consumers behind bars already pay the price of being a captive audience. Those of us in office cubicles may be next.

Kali Tal (kali@kalital.com), *author of* Worlds of Hurt: Reading the Literatures of Trauma, *runs* New Word Order (www.new-word.com/), *a Web development company specializing in academic sites.*

Speech Recognition

By Tamir Maltz

Just as dedicated Net connections are increasingly common, voice-recognition technology will soon permeate the commercial market. This presents a perfect opportunity for the creation of a new kind of computer bug. Such a voice virus will replicate across the Net to find target computers. Listening to everything occurring near the host's microphone, the bug will autoconvert conversations and email home plaintext transcripts, which can then be consolidated into a searchable index. Terrified? I hear you.

Tamir Maltz (tamir_maltz@pobox.com), *a management consultant in Sydney, has written for* Communications Update, Communications Law Bulletin, *and* Journal of Computer-Mediated Communications.

Increasing Returns

By Greg Blonder

If one eternal truth unites all prosperous civilizations, it is the rapid expansion of waistlines. Statistically speaking, we're getting fatter; our children are getting fatter still. Indeed, society after society emerging from lean times soon finds itself too big for its britches. In the future, when engineered drugs and food technology sever the last connection between lifestyle and life span, portly will be as healthy as thin.

Identical clothing will also be in. Despite the trend toward one-to-one marketing, the need to belong to the tribe is even stronger. So instead of several billion clothing styles, our collective destiny reveals indistinguishable hordes of enormous mounds of flesh covered by acres of clinging spandex. Not a pretty picture, but diet, as they say, is destiny.

Greg Blonder (gregeb@research.att.com) *watches what he eats as VP of customer expectations research at AT&T Labs.*

"We have met the enemy, and he is us."
– *Pogo*

Pour two ounces of Skyy vodka over ice and add five ounces of grapefruit juice. Also known as a Greyhound, Skyyhound, Skyy Grapefruit. For exceptionally clean, clear vodka produced by four-column distillation and triple filtration, always reach for the Skyy.

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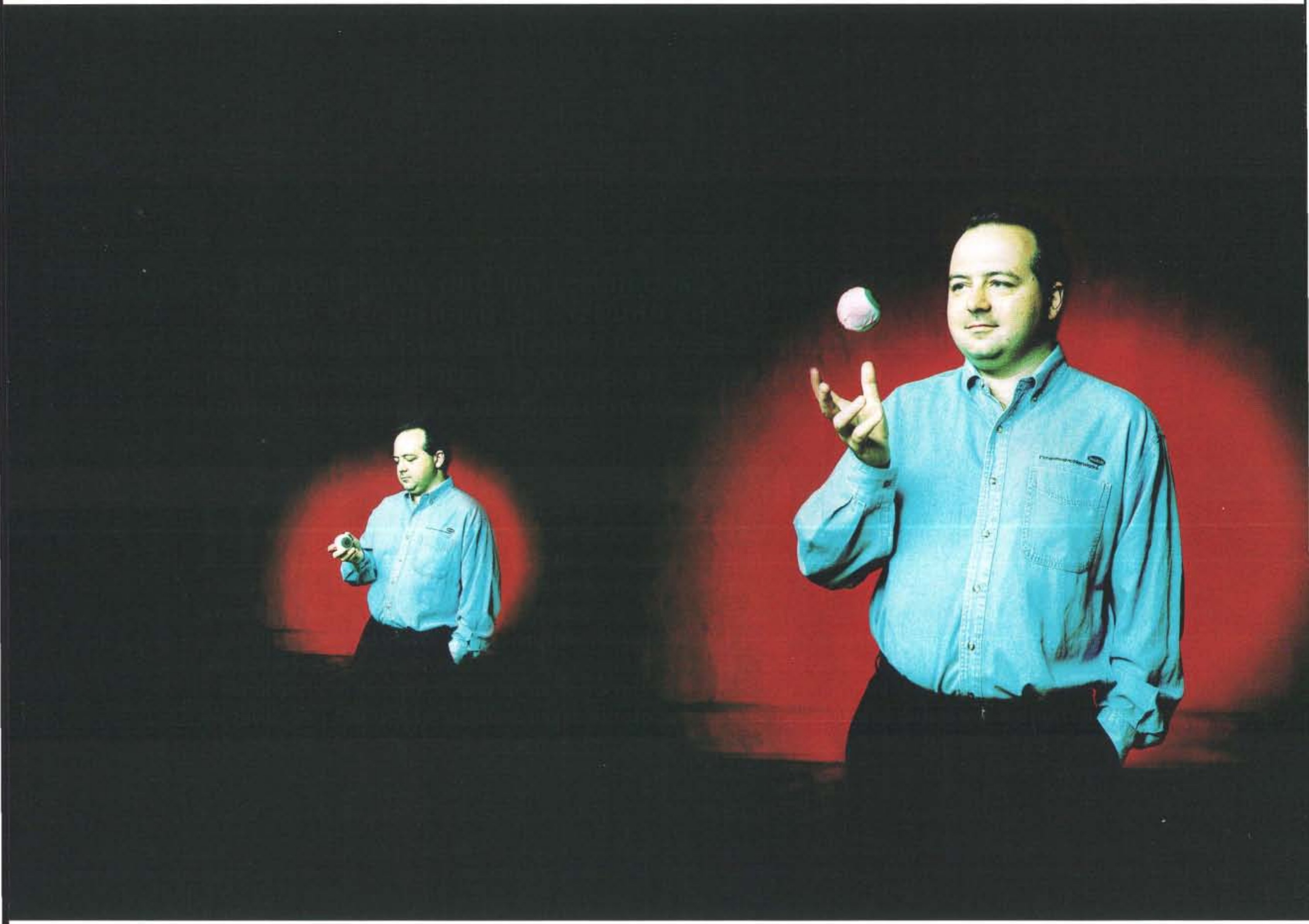
Rob Glaser, his RealVideo, and his recent deals with MCI and Microsoft promise to transform the Net into a mass-market conduit of video content that challenges the vested interests of the TV industry – and could transform his company, Progressive Networks, into a kingmaking Internet powerhouse.



PHOTOGRAPHS: KAREN MOSKOWITZ

Huddled with his crew in the eerie half-light of an empty auditorium in Burlingame, California, at some awful hour of the morning, Rob Glaser is running on adrenaline, plenty of it, plus maybe a quart of Diet Coke and a hundred-odd minutes of "rest," little of it sleep.

"Aright," he tells his huddle. "Timeforadryrun. Withallofthe-demos. Let's makesureitallworks."

Glaser has been through this drill before. His rocketship decade as one of Bill Gates's top lieutenants at Microsoft put him in the public eye plenty. So have his now almost three years at the helm of Progressive Networks, creators of RealAudio, a white-hot Internet technology that gave the once-mute Web a voice.

But this time the circumstances are a bit more challenging, the stakes a bit higher. This is his third keynote in three days (or has it been two days, or four?). The last one was in Tokyo, a dateline and however many time zones away. And this isn't the usual, half-bored trade show audience – these are *his people*; a cavern full of geeks paying up to US$700 each to hear the Progressive gospel over the next two days. And most to the point, what they've gathered for is no cookie-cutter corporate pep rally: it's a full-throttle induction into

Real Revolution

By Robert H. Reid

the ways of Progressive's pièce de résistance, RealVideo.

The stakes RealVideo raises are huge, not just for Progressive but for the Internet as a whole and maybe for the entire exploding universe that used to be called the broadcast industry. In a home-run scenario, RealVideo could transform the Net into a mass-market conduit for all manner of video content – one that could some day challenge the landed interests of the TV industry and transform Progressive into a kingmaking Internet powerhouse. To this end, everyone in the room – a couple dozen people hunched anxiously over computer monitors, sound boards, lighting gear, and speech notes – is a little on edge. "DON'T CUT THE FUCKING VIDEO BEFORE THE AUDIO," Glaser reproaches after somebody cuts the fucking video a little early. OK, maybe a lot on edge.

The auditorium doors open and waves of people – most of them guys, it seems, most of them under 40 – run/walk for the good seats. Many are Web developers, devotees of the black art of streaming media. Others come from TV and radio stations that are starting to pump their offline content onto the Net. There are entrepreneurs, hoping to create the ultimate transmedia jukebox or maybe the next MTV. Plus, there's the inevitable assortment of journalists and investors, trying to make sense of it all.

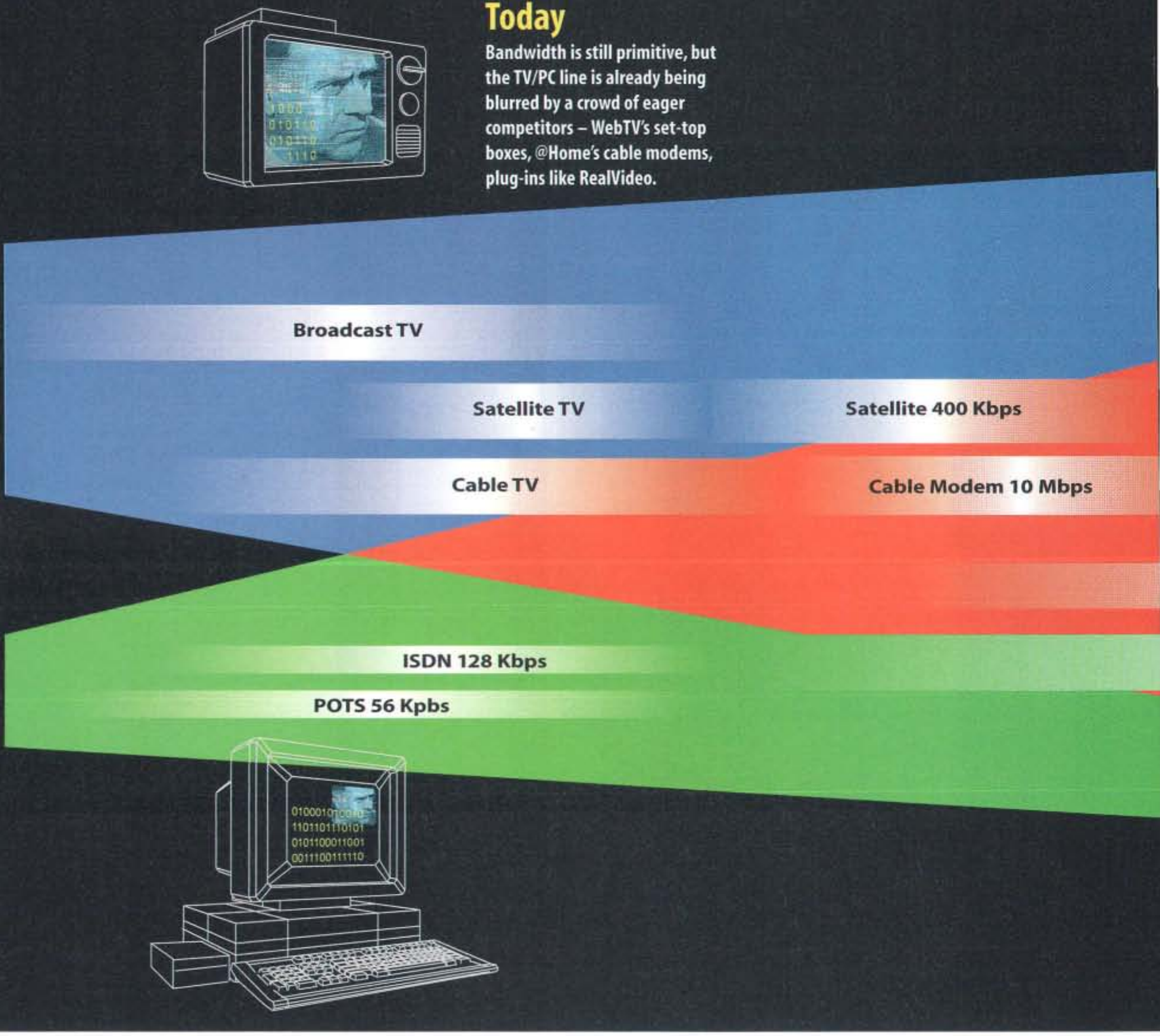
Soon enough, Glaser is at the podium. His speech is titled "The Internet as the Next Mass Medium," and he's belting it out. "We're gonna show all those people," he says, "the ones who say, 'Hey, the Internet's not gonna scale up,' or 'Gosh, there's gonna be bandwidth limitations.'" It almost sounds like a taunt. "We have the technical know-how, collectively. We have the resourcefulness and the commitment." And the crescendo: "You talk about the 15 hours a week that people spend listening to the radio, or 20 watching TV – four or five years from now we'll talk about the 10 or 15 hours a week that people spend experiencing audiovisual information over the Internet. It'll be just a standard part of the media fabric of people's lives. That's the kind of scale we're talking about here."

Glaser is intent, a blur. He machine-guns his words, pumping his arms as if jammin' on the air accordion. RealStuff flashes and dances on the big screens at the front of the room: a RealVideo newscast from Bloomberg News, synchronized to a stock ticker and an external audio track. One of three short films by Spike Lee (Spike Lee!), shot expressly for RealVideo's launch, this one featuring a young tap dancer doting over his shoes ("I like to call them *weapons*, you know what I'm saying?"). Clips showcasing the RealMedia Architecture, a framework for making all sorts of Net-borne media work together (and yes, allofthedemos do work). And for the finale, an animated sequence that portrays a hapless conference attendee who gets abducted by aliens. (Hey, it could happen.)

Hardened Net skeptics would find plenty to snicker about – teensy screen sizes, grainy pictures, jerky motion. But this isn't about re-creating Blockbuster Video online overnight.

TV Meets PC:

The Internet's surge into TV's mass market opens the floodgates for one great river of electronic media. Convergence is redrawing the map for bandwidth to the home, ending television's lop-sided dominance. How soon that happens depends on whether you live near one of the places where high-speed Net access is already being rolled out – or how much you're willing to spend for leading-edge innovations like satellite and wireless. But the end of the bandwidth road is not in doubt: a new, fastest common denominator. As we approach that, the ever-evolving parade of what used to be called TVs and PCs will grow more and more alike.



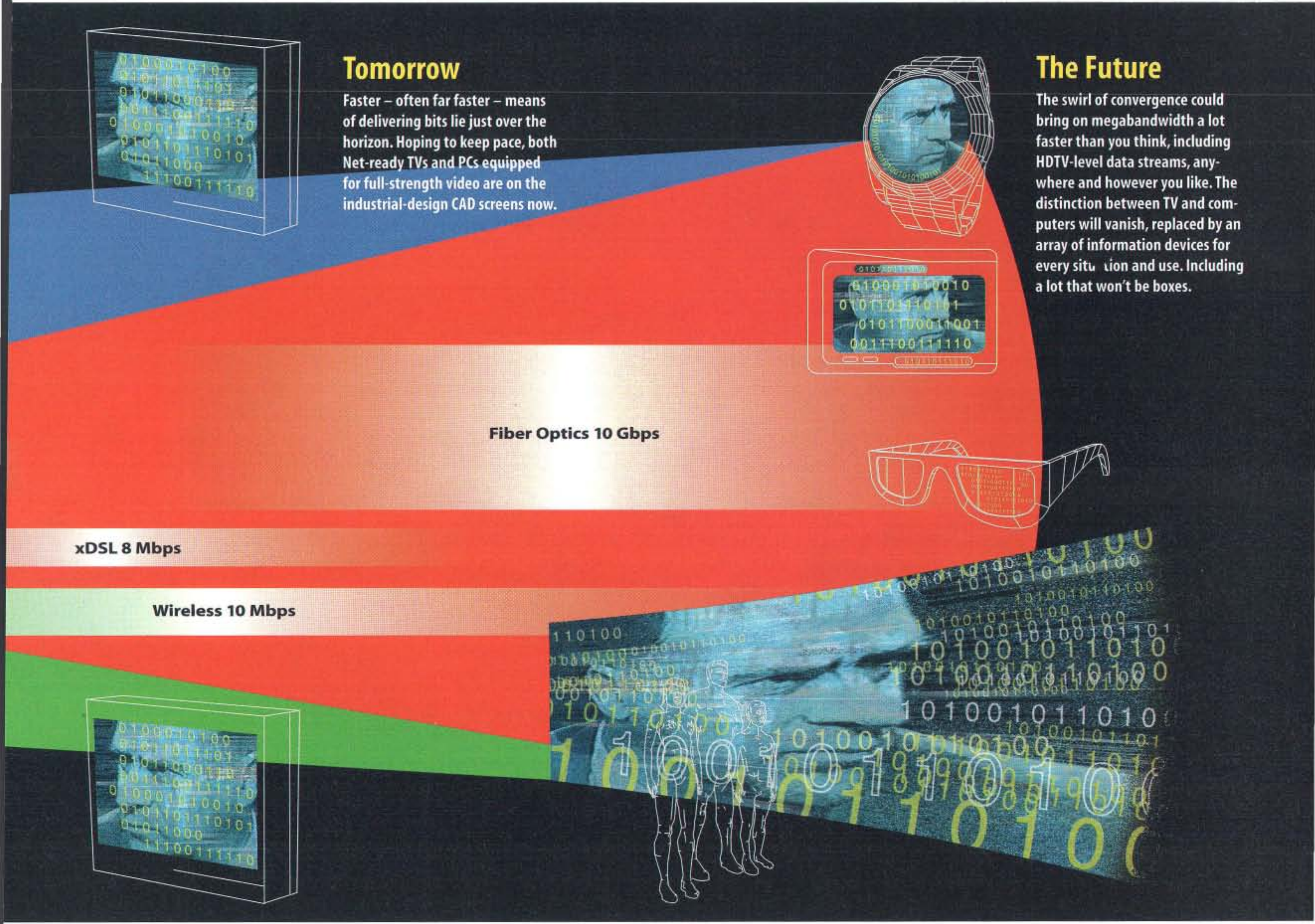
Today

Bandwidth is still primitive, but the TV/PC line is already being blurred by a crowd of eager competitors – WebTV's set-top boxes, @Home's cable modems, plug-ins like RealVideo.

Robert H. Reid (rhreid@rocketmail.com) *is the author of the book* Architects of the Web (www.architectsoftheweb.com/) *and a venture capitalist with the 21st Century Internet fund.*

WIREFRAME MODELS: VIEWPOINT DATALABS

The aim, Glaser says, is to create "something that's good enough to criticize," borrowing researcher Alan Kay's famous quote about the 128K Mac. In other words, 1997 won't go down in history as the year interactive television burst full blown from the Internet's womb. Rather, Glaser explains, it will be for Net video what 1995 was for audio – "the year this really all starts to happen and to come together."



Tomorrow

Faster – often far faster – means of delivering bits lie just over the horizon. Hoping to keep pace, both Net-ready TVs and PCs equipped for full-strength video are on the industrial-design CAD screens now.

The Future

The swirl of convergence could bring on megabandwidth a lot faster than you think, including HDTV-level data streams, anywhere and however you like. The distinction between TV and computers will vanish, replaced by an array of information devices for every situation and use. Including a lot that won't be boxes.

The analogy is a fundamentally bullish one. When RealAudio débuted in April 1995, it was an ear-wearying squall, compromised enough to squeeze through a 14.4 modem. Eyes rolled. But those who dismissed it sneered too soon. Today's RealAudio 3.0, on just a 28.8 modem, can compare with FM radio. Over a broadband connection, it can approach the fidelity of a compact disc. At the same time, a textbook-worthy marketing push has made RealAudio the Net's de facto audio standard. It's running now on 10 to 12 million desktops and thousands of servers, transmitting everything from live NBA games and ABC newscasts to the burgeoning output of garage-based guerrillas like tiny Terraflex of Burlingame, California, whose six overworked employees at last count were streaming more than 50 channels of music onto the Net round the clock – more full-time feeds than any but the largest radio holding companies.

But with RealVideo, Glaser is raising the ante. Television is our most ubiquitous, hyped, and heeded medium. It's Moby Dick to radio's school of minnows, drawing more than $35 billion in ad spending annually in the United States, plus billions more around the globe. But more to the point, TV is now on a collision course with the PC – a modest little $125 billion industry. Companies on both sides of the fence are jumping into the convergence game, bidding up the stakes to dizzying levels. There was the reported $80 million from ABC for Web-weavers Starwave, an estimated $100 million investment from CBS into SportsLine, then two ground-shaking Microsoft deals: $425 million for WebTV and $1 billion into cable giant Comcast. Yet for Glaser himself, the biggest were still to come: July's announcement that none other than his old boss Bill Gates had agreed to embed RealAudio and RealVideo deeply into Microsoft's Internet product line and to take a good-faith 10 percent stake in Progressive Networks as part of the deal. And a second deal announcement two weeks later, with MCI, creating the RealNetwork, a nationwide multicasting backbone that will help resolve the biggest problems that Internet video faces: scarce bandwidth and server overload.

Nobody – not Glaser, not Rupert Murdoch, not even Chairman Bill himself – knows exactly how the convergence game will play out. But Microsoft's adoption of RealVideo is about more than just a move closer to an Internet version of TV's NTSC standard: it's about bridging the shrinking gulf that separates computers and television. What Gates is buying into is state-of-the-art compression technology that squeezes fat, data-rich video signals through the Net's cramped capillaries by carefully removing nonessential data. As that technology improves, as processor speed increases and bandwidth widens, Net video's quality will soar. And as it does, jerky little postage-stamp video patches will blossom into full-screen, high-definition *real* video – skirting the cluttered airwaves and old-fashioned cable toll roads entirely.

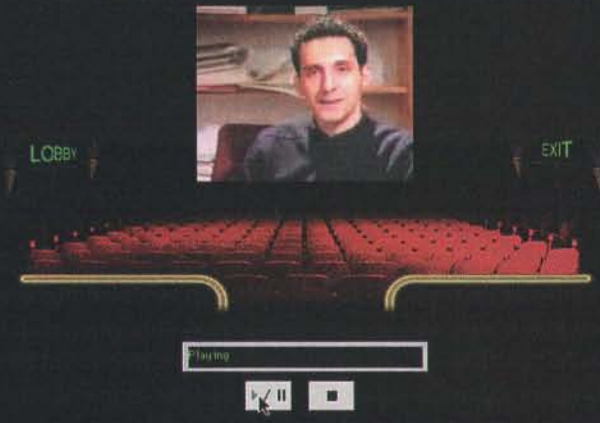
All this could wreak havoc with the competitive dynamics of the TV industry, opening millions of living rooms to any hyperactive kid with a video camera, a computer, and a phone line – which may soon mean most kids in America. Or it could give the likes of Murdoch and Ted Turner an eight-lane highway into the heartland of the traditionally democratized, decentralized Net. Or maybe do both.

RealVideo's teensy, grainy, jerky pictures aren't going to do any of this in 1997. But when the history of post-television media gets written, at least a footnote should be reserved for Glaser and Progressive's superbly executed march on the market: Focusing first on distributing audio over the Net – a far simpler trick, technologically – then springboarding

RealMovies

www.timecast.com/spikelee/theater/lobby.html

Progressive Networks celebrated RealVideo's launch with three new minifilms, produced "exclusively for the Internet" by director Spike Lee. One features actor John Turturro; another students from Brooklyn's PS 183; the third, dancer Savion Glover. Each runs about five minutes, and includes its own virtual theater.



RealStuff

It's still a long way to Sensurround, but streaming video really is bursting out all over the Net. Hundreds of sites have added it to their repertoire, much of it shovelware piped straight from televisionland itself.

Video on the Net is still a small enough world to fit comfortably on a couple of key catalogs, including the Streaming Page *(hyperreal.org/~cyberia/streaming.html)* and Progressive Networks's own Timecast *(www.timecast.com/)*. *Wired* sifted through the noise, and came up with some pioneering sites worth noting.

ABCNews.com

www.abcnews.com/

Peter Jennings gets wired: Hourly newscasts, clips from breaking stories, and special reports.

Citizen-tv

www.citizen-tv.com/

Multimedia with a message, from Adbusters to Noam Chomsky.

C-Span Online

www.c-span.org/

The perfect DC policy-wonk tool: talking heads live – and archived.

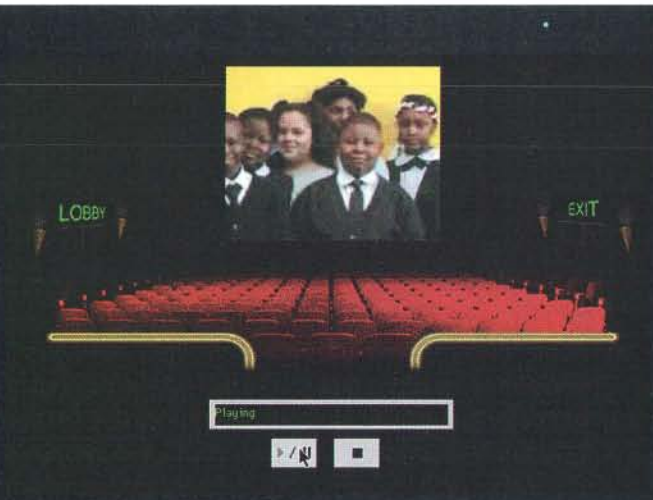
into video by converting an already critical mass of established users. Doing loss-leader content deals with audience magnets like ABC and NPR. Going engineer-to-engineer against Microsoft's own streaming audio and video product, NetShow. And finally winning (or was it re-winning?) the notoriously fickle allegiance of his old boss – instead of being bought out at a fire sale price or crushed, the usual fate of would-be Microsoft competitors.

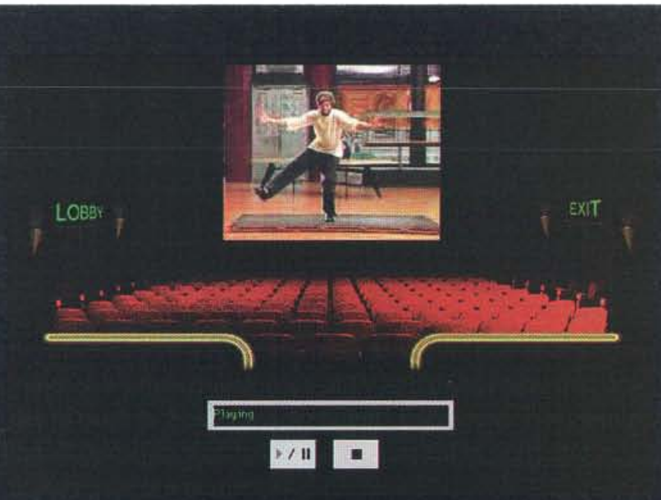
After the speech, with sleep deprivation in full retreat, Glaser's adrenaline levels – and maybe a splash of Diet Coke – have him crackling. "This is big," he says, barely restraining those accordion arms. "So big." What he's talking about is not just the conference (although it's plenty big) nor RealVideo (although he hopes it will be, too). Rather, it's the relentless spread of the mass-market Web, the steady expansion of bandwidth, and the market-warping, at times contradictory, transformations those changes are unleashing. It's the rise of a medium that's both as personalized as a shopping list and as broad-reaching as *Seinfeld*. It's the grassroots invasion into Big Media and the concurrent Big Mediafication of the open Internet. It's the convergence of TV and online networks, the rise of push in a pull-based medium, and, above everything, the intoxicating fact that we're still just three years into a twenty-year phenomenon.

Glaser can go on about this at auctioneer velocities – for days. About how the coming media landscape will be transactive: "You can show a commercial, and let someone order the product or service being offered straightaway. Or you can play a song and let them order a CD." That it will be on-demand: "You can see or hear something when you want, not just when it happens to be broadcast." And, perhaps best of all, how it will have no bounds: "Content will no longer be limited to 3 networks or 36 cable channels, but rather by production economics."

Glaser sets his empty Diet Coke can down next to, well, another empty Diet Coke can, and prepares to sum up.

174 ►





Fox News

www.foxnews.com/

Watch out, Ted Turner. Murdoch's upstart news channel, hard to find on cable, uses the Net as an equalizer.

Liveconcerts.com

www.liveconcerts.com/

Live and onstage, from Lollapalooza to the Back Street Boys. Includes both scheduled cybercasts and an archived back list of concerts.

Radio Television Hong Kong

www.rthk.org.hk/

Relive the 1997 handover, brush up with "One Minute's Chinese," and get the round-the-clock news – in English or Cantonese.

Trinity Broadcasting Network

www.tbn.org

Live from Irving, Texas: Gospel music, call-in shows, and Christian movies from "the world's largest Christian network."

Wiring the Jet Set

Boeing is equipping factory-floor workers with a modified VR setup – and rapidly cutting the time it takes to wire new jetliners. By Jim Nash

Photographs by Norman Mauskopf

Artificially augmenting your reality on the job is usually a quick way to get fired. But at Boeing's 98-acre aircraft assembly plant in Everett, Washington, factory workers using waistband PCs and a monocular-goggle setup are doing just that to shave time and money off the tricky task of wiring jet planes.

In a pilot project begun in June, the jetliner giant purchased five off-the-shelf augmented reality (AR) outfits. Each setup consists of headgear (position-tracking hardware and a VGA-resolution see-through display) and a waistband Windows-based PC. Boeing programmers wrote the AR software from scratch. The cost for each system prototype is between US$8,000 and $16,000 – although that is expected to drop if volume production begins.

The headgear weighs less than a pound, the waistband computer about 3 pounds (half of which is the battery). When snapped on, the outfit gives workers a strange sci-fi appearance. "They do look Borglike," laughs an employee involved in early tests. "But we ►

Jim Nash (jimeditor@aol.com) *is an assistant news editor for the* Chicago Tribune.

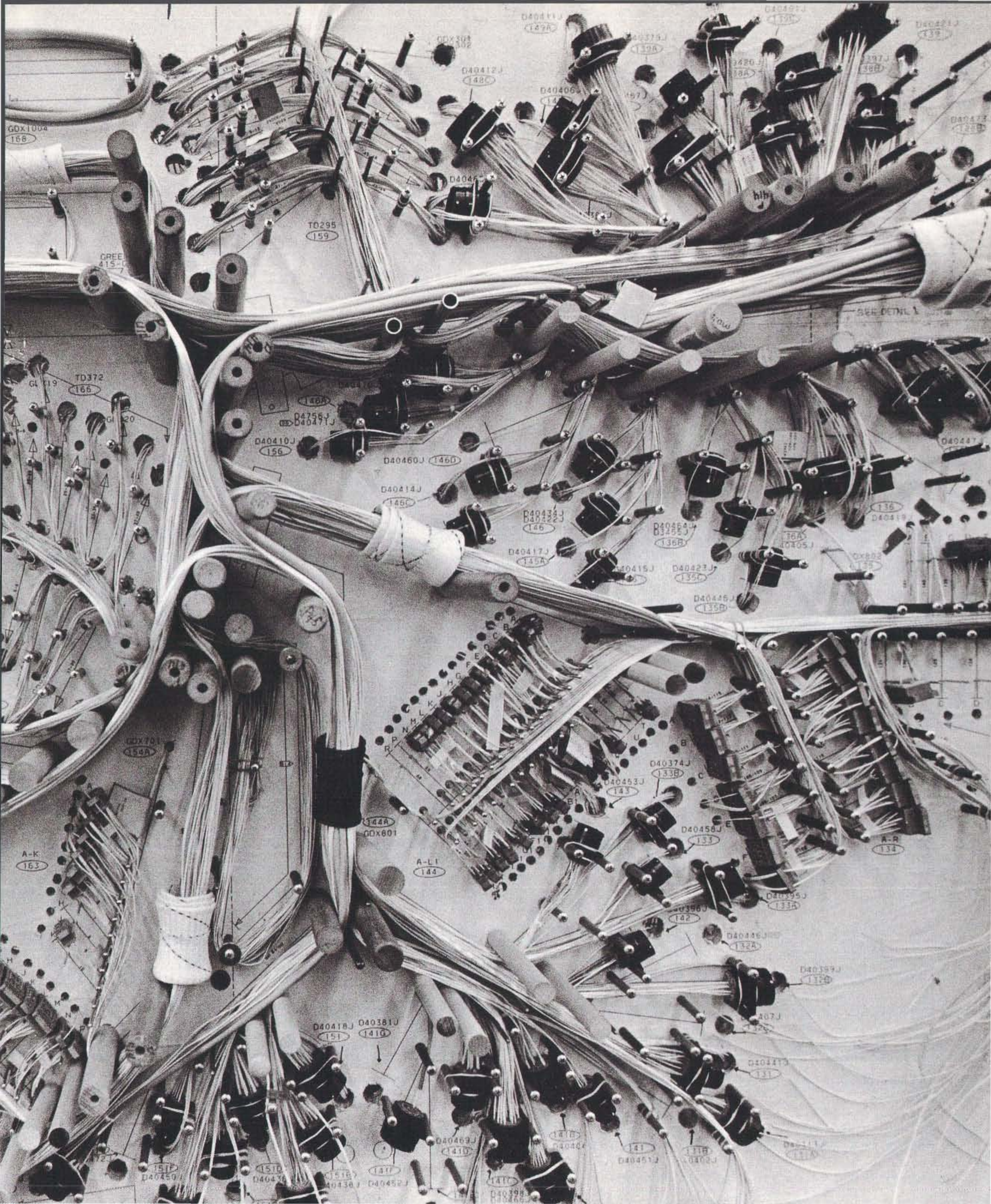
David Mizell (left), who manages Boeing's augmented reality project, sports one of the ultrachic headgear rigs used by wire-shop workers. The futuristic setup continually monitors head position and recalculates the graphics in the monocular eyepiece, making the electronic information appear fixed in space.

The average Boeing aircraft contains hundreds of miles of wire, bundled in lengths from 2 to 120 feet. Conventional wiring assembly called for repeated references to paper schematics, called Shop Aids, that are associated with each wire bundle. This data is now projected in the AR display frame, appearing at the point on the assembly board where the wire is being routed.

► haven't noticed them walking around like zombies saying 'Resistance is futile.'"

Boeing's wireshop employees are the factory-floor guinea pigs. Managers selected AR participants from volunteers, mixing in both greenhorns and veterans. Stringing the hundreds of miles of wiring inside an aircraft is a good test for AR: virtually every jetliner Boeing makes is customized, a lengthy and complicated process.

A 747, for instance, has about 1,000 wire bundles, ranging in length from 2 feet (inside electrical panels) to 120 feet. The bundles can contain hundreds of wires, each of which might bring light to seat 27E or control signals to the cockpit. Workers typically place the longer bundles onto customized formboards that approximate how wires will be strung throughout the plane. Assemblers must bounce from computer printouts to the formboards to see which bundles get linked to which connectors. Builders sometimes work with only a single wire at a time, using schematics glued to the boards. Mistakes can be costly – improperly strung bundles must be rebuilt. ►


GDX304
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D40451J
131B
D40402J
151F
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D40398J
131A

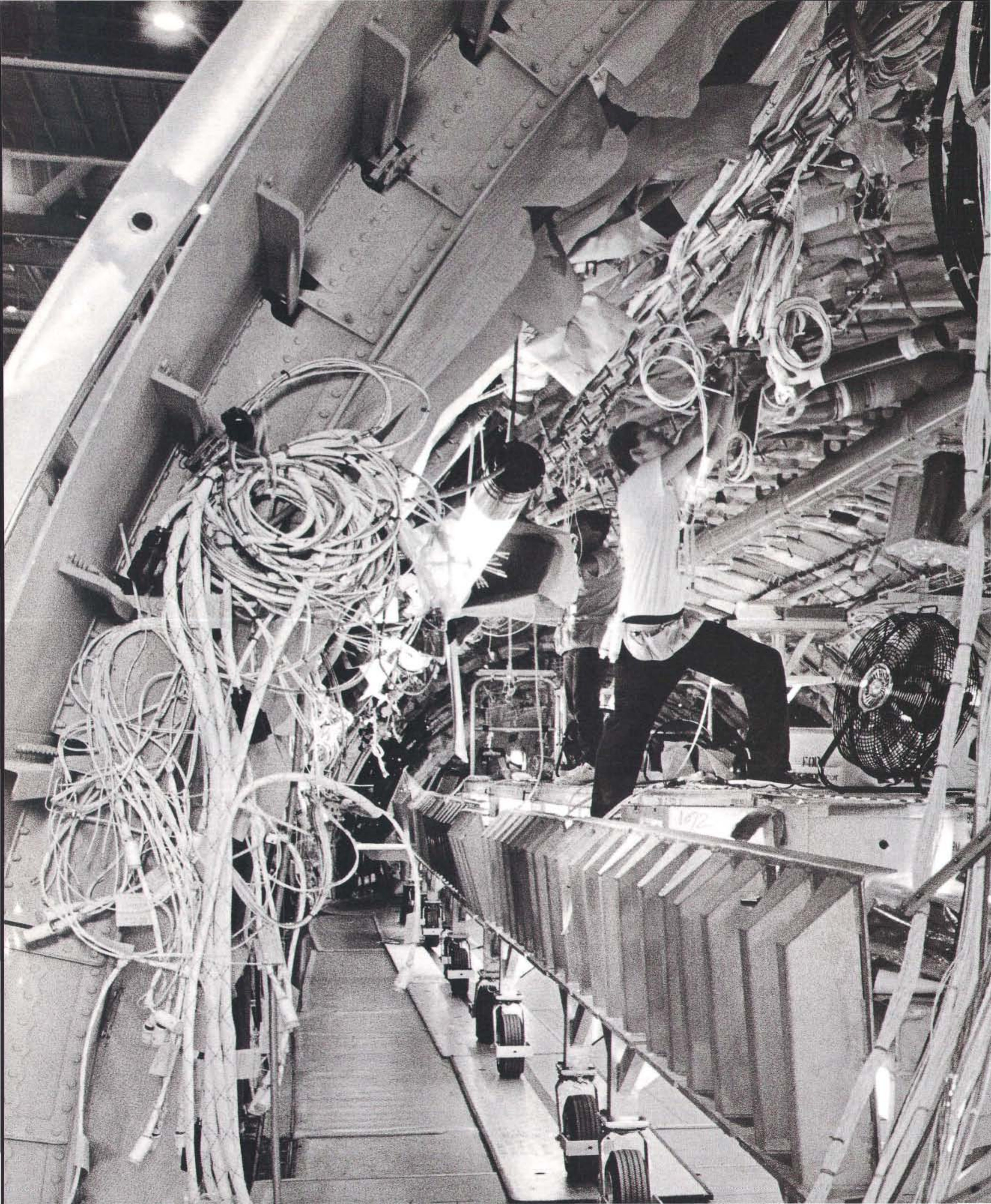
Boeing's sprawling assembly plant in Everett, Washington, encloses 472 million cubic feet of space. Building aircraft like the 747 is a monstrously complex and expensive task. A single plane may contain as many as 250 types of electrical wire and cost upward of $170 million. AR has cut portions of the time-intensive wiring process in half.

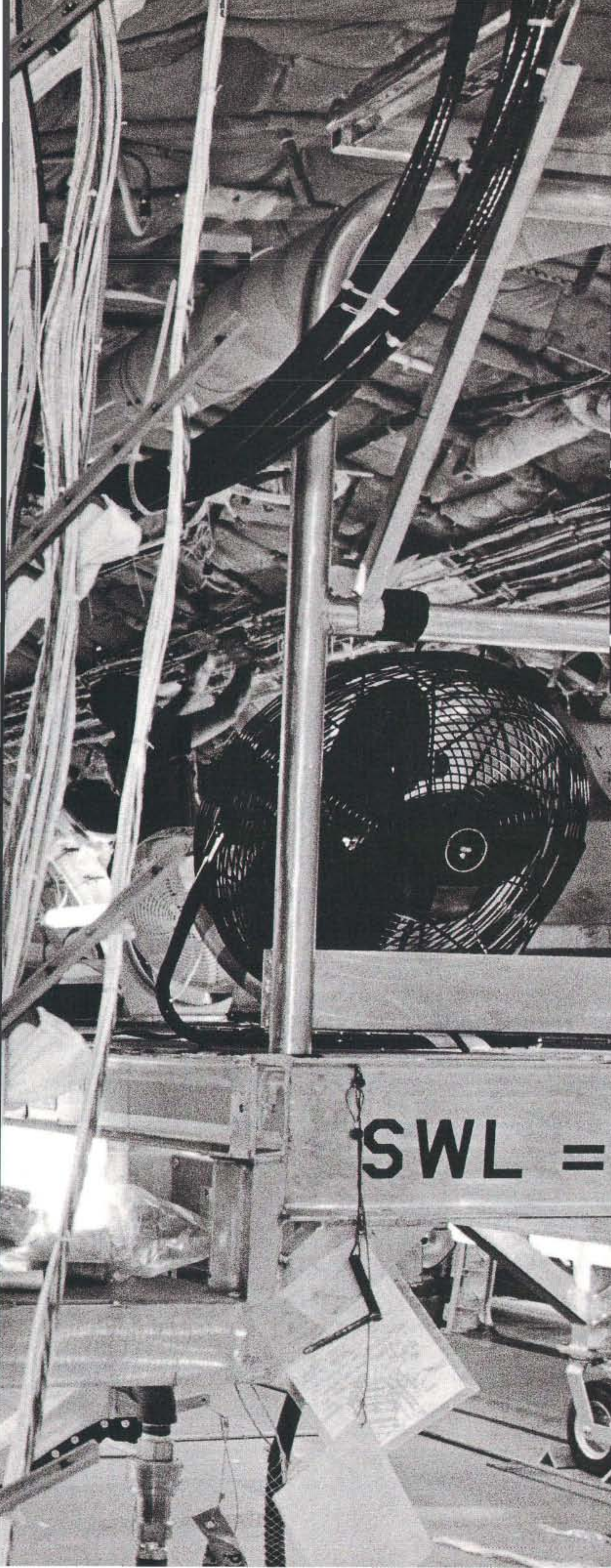
► The AR setup offers a guiding electronic hand that frees assemblers from repeatedly checking paper diagrams and parts lists. One position-tracking system Boeing is testing works like this: Each formboard is painted with distinctive dots of various sizes. A video camera on the headset transmits images of the dots to a database that can determine, based on the number and size of the dots viewed, exactly where the worker is in relation to the board. The AR software also reads the pitch and yaw of the worker's head.

With the monocle in place, employees see not only their workspace, but also an overlaid monochrome assembly diagram that has been imported wirelessly from a graphical database. Text messages indicate which connectors are needed on which wires, explains David Mizell, Boeing's virtual systems manager.

So far, the project has hit very few technical snags. "The hardest technical issue is the position/orientation tracker," Mizell says. "It has to be small, accurate, long-range, fast, and cheap. Those attributes don't often show up at the same party." ►

777
The legend lives on.
BOEING 777

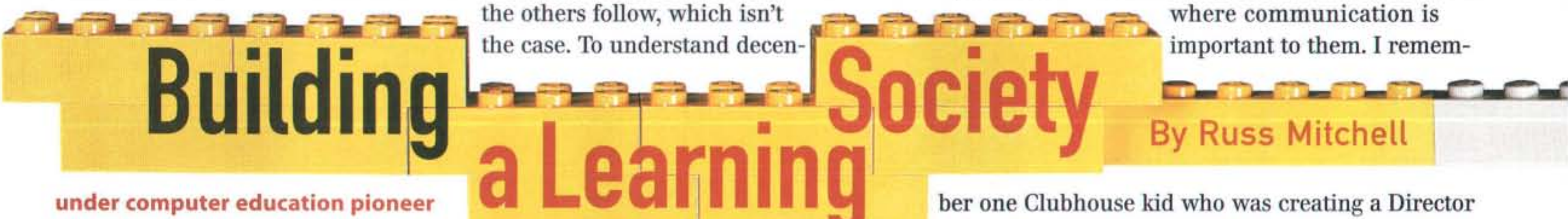




Wiring bundles, often containing hundreds of connections, are dispersed on 3-foot-by-8-foot easels, called formboards. The bundles are then installed in the aircraft. The optics of the monocular display have a focal length of about 20 inches. Working at arm's length, the electronic information appears to be drawn on the board.

► The AR project – which involves 10 factory workers, support staff, and managers – is primarily exploratory, and it's not yet known how it will translate into overall cost savings on jetliner construction. But even a small percentage change would be significant – the price range for a 747 (more than 1,100 have been delivered) is $156 million to $174 million; the 767 (more than 650 delivered) runs $77 million to $107 million, while the 777 (more than 70 delivered) costs between $128 million and $171 million. Early indications are good that AR will create significant time savings. A test in 1995 using a crude AR prototype allowed workers to complete their wiring 20 to 50 percent faster – mostly because workers no longer have to look at parts lists.

Mizell sees a growing need for AR at Boeing. He says many jobs in aircraft manufacturing are done by hand – they are too complex, or not done often enough, to justify automation. Still, "if you can give workers the info they want right at the workplace," he says, "there's going to be a payoff." ■ ■ ■



Building a Learning Society

By Russ Mitchell

Mitchel Resnick is a rising star at the MIT Media Lab. His goal: inventing technologies that radically change how and what kids learn, fostering "decentralized thinkers" who are comfortable with bottom-up interactions, not top-down control. A former *Business Week* writer, Resnick, 41, switched careers to earn an MIT PhD under computer education pioneer Seymour Papert. He adapted Papert's Logo computer language for use with Lego toys. Later, he created StarLogo, which lets kids build complex systems like anthills and bird flocks. His new book is *Turtles, Termites, and Traffic Jams* (MIT Press).

Wired: What's decentralized thinking?

Resnick: In a decentralized system, lots of simple parts interact with one another in simple ways, with no single part in charge - birds in a flock, cars on a highway, buyers and sellers in a market economy. Most people resist this idea. When they see patterns in the world, they assume centralized control where it doesn't exist. I try to help people develop better intuitions about decentralized systems, so they can better understand the workings of the world - and better create new worlds.

Why is this kind of thinking so important?

Corporate structures, scientific theories, computer architectures, political and economic models are all becoming more decentralized. And the Internet is accelerating this trend. If today's kids want to succeed in tomorrow's world, they need an appreciation for decentralized approaches. Whether they end up creating organizations, technologies, communities, or theories, they'll need to think this way.

How can we prepare children for this?

Just showing decentralized systems to kids isn't good enough. People see bird flocks all the time, but still assume the bird in front leads and the others follow, which isn't the case. To understand decentralized systems, children need opportunities to design, create, play with, and explore decentralized systems. StarLogo software lets kids do that. For instance, students use StarLogo *(www.media.mit.edu/~starlogo/)* to create a flock of artificial birds on the computer. The kids write simple rules for each bird - telling each how to interact with neighboring birds. Then they observe patterns that form when they let loose hundreds of the birds. Kids have used StarLogo to create termite colonies, traffic jams, market economies. They learn that organized patterns can arise from a few simple, local rules. You don't need a leader.

Will computers in the classroom help?

When schools introduce computers, they usually perpetuate traditional ways of teaching and learning. What we need to do is rethink the process of learning in a way that's suited to the digital age. The traditional approach of the teacher who transmits information to the learner is very centralized. We need to find ways for learners to take more responsibility for their own learning. It's wrong for educators to think they can totally control how and what someone is going to learn. That doesn't mean leaving kids on their own. It's more like tending the soil so good plants will grow, less like building a product.

Nice theory. How does that work in real life?

We've started an after-school learning center in inner-city Boston called the Computer Clubhouse *(www.tcm.org/clubhouse/)*. We let kids explore their interests, with support from adult mentors, and we've seen group projects organize on their own. One team wanted to create a laser light show. Some of the children worked on the computer program, some worked on the mechanism for the laser light, others on the math of the patterns the laser might draw. There was lots of support, but it wasn't preplanned. We want to give kids enough freedom so they can explore their own fantasies, but we also want to give them enough support to help make their fantasies come true.

I can imagine some critics saying, "Our schools have bigger problems with basic reading, writing, and math."

When people see that schools aren't performing well, often their first inclination is to go back to basics. But the best learning situations aren't where you're drilling some facts into the learner. The most obvious example is the way children learn to talk. No one is drilling them on conjugating their verbs. They live in an environment where communication is important to them. I remember one Clubhouse kid who was creating a Director animation. To make objects meet at exactly the right time, he had to do some calculations about relative speed. He said that when he was learning about speed and time and distance in school, it didn't matter to him. So he never really learned the stuff. Now he wanted to learn it because he wanted to create this animation.

In promoting new ways to teach and learn, you're bucking one of the most centralized systems there is.

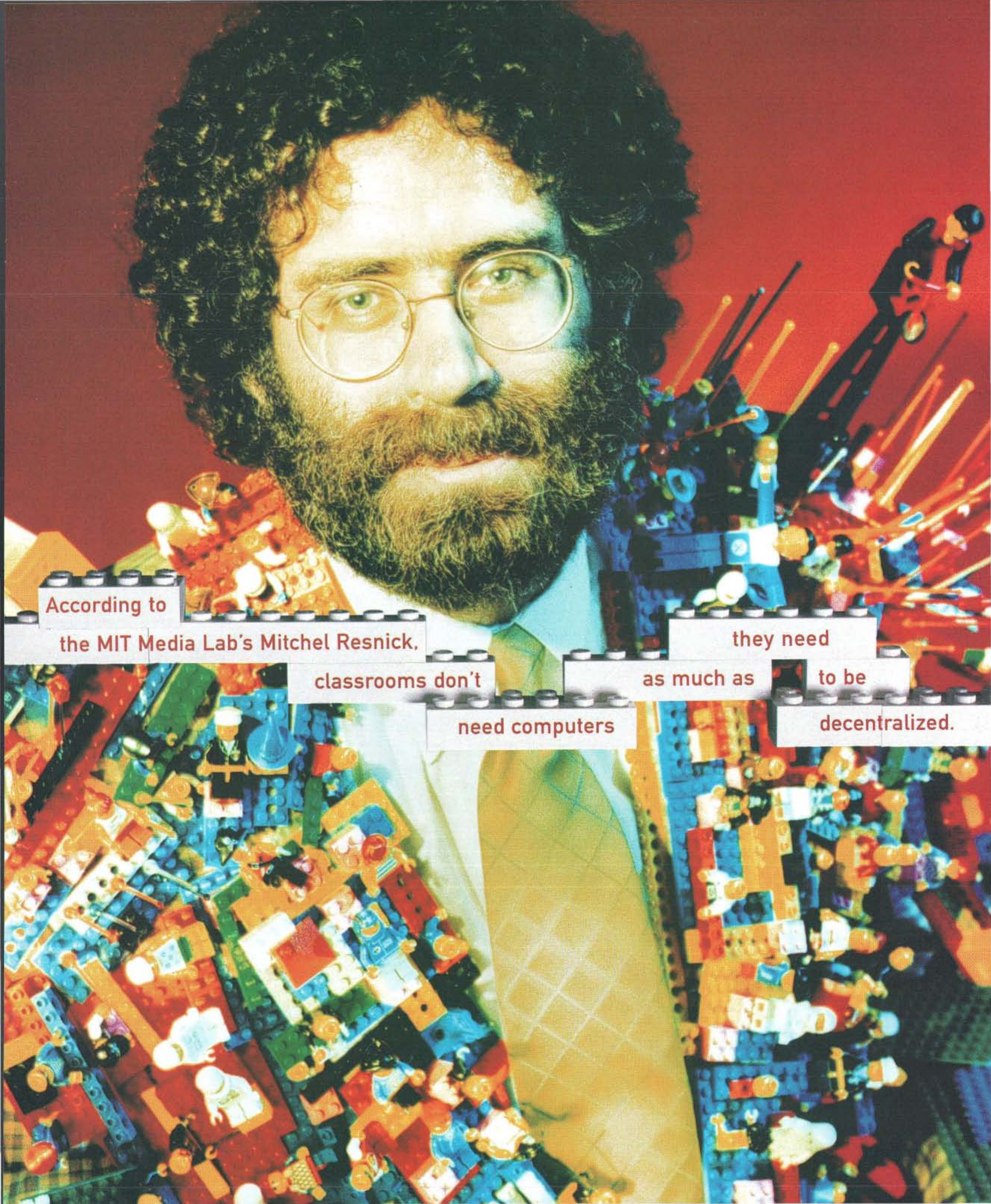
There are huge barriers in the education system. But we're seeing the beginnings of people recognizing there's a need for deep change. The same way that people have grown to understand the importance of diversity in an ecological system, we need to understand the importance of diversity in educational systems.

You believe the Internet is accelerating these changes.

The most profound effect of the Internet might not be in any of the content or information or people that we can get access to. What's most important is that it provides a new metaphor of decentralization, a model that we can apply to the way we think about many other things in the world. ■ ■ ■

Russ Mitchell is a senior writer for U.S. News & World Report.

PHOTO: ASIA KEPKA



According to the MIT Media Lab's Mitchel Resnick, classrooms don't need computers as much as they need to be decentralized.

CARS THAT GO 5,000 MILES BETWEEN FILL-UPS,
ELECTRIC POWER PLANTS YOU BUY LIKE APPLIANCES,
A WORLD WITH RADICALLY REDUCED POLLUTION,
AND A BETTER STANDARD OF LIVING ...

SOUNDS LIKE A SCI-FI PIPE DREAM – IF IT WEREN'T
FOR ALL THESE AUTOMOBILE AND POWER COMPANIES
SPENDING BILLIONS TO MAKE IT REAL.

DAWN OF THE HYDROGEN AGE

BY JACQUES LESLIE

I'm at the headquarters of Ballard Power Systems in Burnaby, a suburb of Vancouver, and my big fuel cell moment is about to occur. Following the example of the premier of British Columbia, the mayor of Chicago, and the chair of the Los Angeles Metropolitan Transit Authority, I am going to drink the exhaust from Ballard's prototype fuel cell municipal bus. This is less foolhardy than it sounds, since the only emission from the fuel cell engine is water. For this reason, many people think that fuel cells can change the world.

At Ballard, the exhaust-drinking routine has grown so tiresome that when I ask for a sip, Paul Lancaster, Ballard's treasurer, doesn't even offer me a glass: he suggests I cup my hands under the bus's exhaust pipe. The pipe points straight down, presumably because its effluence is not a noxious gas that must be spewed into the atmosphere in hopes that it will dissipate. I bend over, and, within a few seconds, I collect several teaspoons of warm, clear liquid. As I begin to drink, I try to imagine a mountain stream, but the water is disappointingly bland. "Like distilled water," Lancaster explains, and I realize that what I'm drinking is, in a sense, exactly that – the pure product of the union of hydrogen, the element that powers fuel cells, and oxygen in the engine. In some engine designs, even the exhaust water becomes an asset, recirculated to aid in internal processes. One tenet of the coming hydrogen age, according to businessman-*cum*-fuel cell visionary Joe Maceda, is that "pollution is a measure

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Jacques Leslie (jacques@well.com) *is the author of* The Mark: A War Correspondent's Memoir of Vietnam and Cambodia. *This is his eighth piece for* Wired.

Building the Hydrogen Economy

In April 1997, Daimler-Benz announced a US$295 million investment in fuel cell technologies. Toyota is spending an estimated $700 million a year to develop alternative-fuel cars.

Last May, ARCO and Exxon announced a multimillion-dollar fuel cell-related research alliance with Delphi Energy & Engine Management Systems, a division of General Motors.

These are just a few of the big players migrating toward the hydrogen economy. You may recognize some of the others ...

- Exxon
- Ford
- Chrysler
- Westinghouse
- DuPont
- General Motors
- Sandia National Laboratories
- Toyota
- Texaco
- Daimler-Benz
- Lawrence Livermore National Laboratory
- Rocky Mountain Institute
- Renault
- 3M
- Honda
- Siemens
- Nissan
- Volkswagen
- Jet Propulsion Laboratory
- Fluor Daniel
- Los Alamos National Laboratory
- BMW
- PSA Peugeot Citroën
- Schatz Energy Research Center
- AlliedSignal
- Mazda
- Motorola
- Volvo
- ARCO

of inefficiency, and inefficiency is lost profit."

After decades of unfulfilled promise, fuel cell momentum is now so great that its emergence as a predominant technology appears just short of inevitable. During the early 1990s, nearly every major car manufacturer in the world launched a program to build a fuel cell automobile. Then, in April, a stunning announcement by Daimler-Benz AG suddenly gave the fuel cell age a timetable. Mercedes-Benz's parent company said it was investing US$145 million to buy a one-quarter interest in Ballard, the world's leader in fuel cell technology, and $150 million toward a joint venture with Ballard to create a new vehicle fuel cell engine company. Daimler-Benz also announced that beginning in 2005, the new company would produce 100,000 fuel cell engines annually. This is a remarkable figure, considering that the company, the world's 15th-largest auto manufacturer, makes only 700,000 cars a year now.

"Daimler-Benz has a history of being one of the more conservative companies in the auto business, and arguably the auto business is one of the more conservative industries in the world," says Bill Reinert, a Toyota mechanical engineer. "So when somebody like Daimler pours millions of dollars into a technology and comes up making a statement like that, you have to say this might be pretty serious."

It is hard to overstate the implications of a transition to hydrogen power:

A transformation of the auto and petrochemical industries. A complete makeover of the electric-utility industry. An epochal geopolitical shift as global reliance on Middle East oil comes to an end and international trade balances are realigned. Not to mention a drastic decline in air pollution, oil spills, acid rain, and greenhouse-gas emissions. Besides that, nothing much.

Though Daimler's fuel cell car will be powered by methanol, a hydrogen-rich derivative of natural gas, it is widely assumed that the use of fossil fuels to power fuel cells will be transitional, leading to an era in which hydrogen is extracted from sustainable energy sources. It is hard to overstate the implications of such a development: A drastic decline in air pollution, oil spills, acid rain, and greenhouse-gas emissions. An epochal geopolitical shift as global reliance on Middle East oil comes to an end and international trade balances are realigned. The emergence of quiet, decentralized electric plants sized according to need - small enough to power your car (and perhaps, at night, your house); big enough to power a town of 15,000 people, or, in tandem, a city. The disappearance of the electric grid is a possibility; a makeover of the electric-utility industry is nearly certain.

It is likely to take 50 to 100 years to achieve a mature "hydrogen economy," but the impact of fuel cells should be felt long before that. Over the next decade, products are likely to emerge on the market that are both more efficient and more environmentally benign than their predecessors. The century-long reign of internal-combustion engines will almost certainly be challenged by fuel cell-powered cars and buses that are quiet and clean, and use energy far more efficiently than today's vehicles. Naval forces in several countries are looking into fuel cells to run submarines and provide auxiliary power on oceangoing vessels; the US Army is building a backpack-sized fuel cell generator that can power a soldier's electronics gear, from night-vision goggles to infrared heat detectors. Fuel cell-driven desalination plants may offer clean water cheaply, defusing a potentially critical 21st-century resource shortage. Within a few years, fuel cells will probably power professional video cameras and many other products that now use batteries. Your laptop may eventually run on a fuel cell whose range is measured in days, not hours.

To be sure, all this is heady stuff considering that no commercial products now use the technology. (The one quasi-exception is a 200-kilowatt power generator manufactured by International Fuel Cells of South Windsor, Connecticut. IFC has installed more than 90 units to power buildings ranging from hospitals to casinos to jails, but the US Defense Department subsidized a third of the $600,000 price tag for 70 of the units.)

Nevertheless, fuel cells are poised to ride some powerful historical trends. For one thing, the trend in energy use over the last one and a half centuries has been toward reduced carbon consumption and increased use of hydrogen. Each predominant feedstock - from wood, through coal, then oil, natural gas, and, ultimately perhaps, renewables - has contained more hydrogen and less carbon than its predecessor, and each successive fuel has been cleaner and more powerful.

In addition, just as computer telecommunications has promoted information decentralization and dematerialization, fuel cells promise to untie energy consumers from centralized power generators - you might say that energy wants to be free. "The information revolution and the coming energy revolution are similar in that we are using human ingenuity to replace energy and raw materials," says Joseph J. Romm, acting assistant secretary for energy efficiency and renewable energy at the US Department of Energy. "We can use information technology to avoid travel and transportation, and we can use energy technology to reduce energy consumption, pollution, and our use of natural resources. Both revolutions represent a fundamental transition to a world in which we are not resource constrained, yet we have a higher standard of living."

The irony is that for all of this technology's potential benefits, the one thing it notably lacks is strong public support. As William Hoagland, president of the fledgling advocacy group Hydrogen 2000, points out, "There are a lot of political and other forces supporting the conventional fuel structure, and we don't have a hydrogen industry or a public constituency asking for change." The US government has spent hundreds of millions of dollars in fuel cell research and development over several decades, but in recent years, as that investment has finally borne fruit, the public perception - well represented in Congress - is that fuel cells are a stagnant technology. "The last few years have created a lag between what fuel cells can do, what funding ought to be, and what everybody's understanding of them is," Romm says.

As the US Environmental Protection Agency's newly toughened clean-air standards and the upcoming international meeting on global warming in Kyoto focus attention on combating pollution, the technology's stature in the US is likely to rise. Indeed, Romm says it is understood at the DOE's "highest levels" that fuel cells will be part of President Clinton's evolving strategy to counter climate change. Nevertheless, more than one-quarter of the department's current $16 billion budget is spent on nuclear-weapons management, while all fuel cell programs together amount to about $90 million. Sandy Thomas, a researcher at Directed Technologies Inc. who consults for Ford Motor Company's fuel cell vehicle program, says, "If I could take 1 percent of the nuclear-weapons budget from the Department of Energy and put it into hydrogen fuel cells, that would probably take 10 years off hydrogen development. But the weapons budget is sacrosanct - you can't attack it, even though we don't build, test, or explode nuclear weapons any longer."

Compared with the internal-combustion engine (ICE), the fuel cell engine is a simple, if elegantly engineered, device. Its lineage dates to 1839, but it wasn't until the early 1960s, when NASA began using the technology to power spaceships, that fuel cells found their first application. Unlike an ICE, which runs on high-temperature explosions, most fuel cells rely on relatively cool electrochemical reactions. The fuel cell has no moving parts: as hydrogen feeds into the cell, the catalyst, a thin layer of platinum, induces the gas to separate into electrons and protons (hydrogen ions). In the case of the proton-exchange membrane (PEM) fuel cell, the technology favored to power cars, the protons pass through a membrane to combine with oxygen on the other side, producing water. The electrons, which cannot pass through the membrane, are channeled along an external route through an electric motor, which the electrons drive. The process is two to three times more efficient than that of an ICE, and its only by-products are electricity, water, and a moderate amount of heat.

"Fuel cells are much more natural," says Joe Maceda, the visionary who this year formed Power Technologies Corporation, which, among other things, markets fuel cell-driven desalination plants. "Human beings, for instance, are basically electrochemically driven

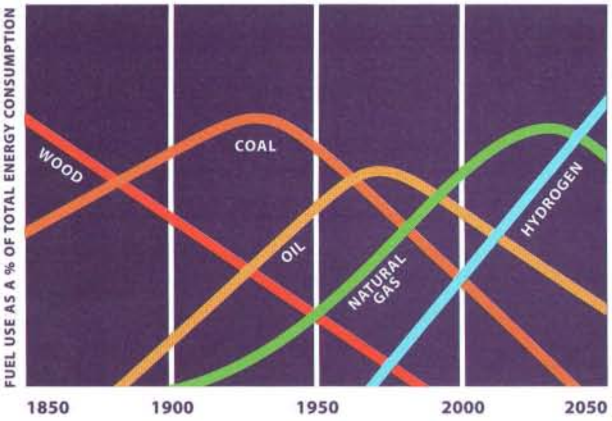
Energy Trends: the Rise of Hydrogen

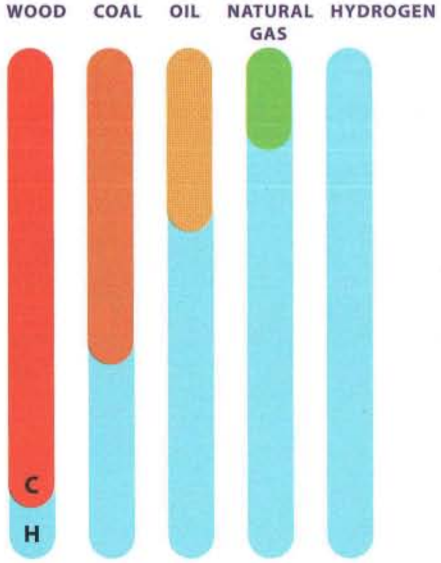
The trend in energy use worldwide clearly presages a hydrogen era.

The timeline below shows the historical march from wood through coal, oil, and natural gas to the projected use of non-fossil fuels, including solar energy, wind, and hydrogen. The lower chart illustrates the carbon-to-hydrogen ratio of each energy resource.

While each fuel has been cleaner and more potent than its predecessor, it has also required more sophisticated technology.

Our decreasing dependence on carbon-based fuels has resulted in a steady rise of hydrogen as the driving fuel of the world's economy.





CENTER CHART: AUSTRIAN INTERNATIONAL INSTITUTE OF APPLIED SYSTEMS ANALYSIS; LOWER CHART: WIRED

Think of Ballard as the Intel of the fuel cell industry:

Just as the Silicon Valley giant tapped a vast market by providing microprocessors for many computer brands, the Canadian firm hopes to build fuel cells for a virtually unlimited array of products, from buses to cars to fuel cell furnaces. The Mercedes-Benz bus (right) is based on Ballard's prototype fuel cell bus engine. The Mercedes NECAR II (upper left) is also a Ballard design. Chrysler, another Ballard partner, has built a gasoline-powered fuel cell engine.

But Ballard and its partners aren't the only players. Scattered across the continent, this "Hydrogen Valley" is teeming with companies you haven't heard of – yet.

Fuel Cell and Hydrogen Specialty Companies

- AeroVironment
- Air Liquide America
- Air Products and Chemicals
- BOC Gases
- Ball
- Bechtel
- DCH Technology
- DTI Energy
- Electrochem
- Energy & Environmental Research
- Energy Conversion Devices
- Energy Partners
- Energy Research
- Energy Systems
- Foster-Miller
- Foster Wheeler
- Fuel Cell Corp. of America
- H Power
- Hydrogen Burner Technology
- Hydrogen Components
- International Fuel Cells
- M-C Power
- Meruit
- PSI Technologies
- Pan American Enterprises
- Plug Power
- Power Technologies
- Praxair
- Sofco
- Spectracorp
- Technology Management
- Tecogen
- Teledyne Brown Engineering
- Thermo Power
- Vairex
- W. J. Schafer Associates
- Ztek

membrane processes. We take in oxidant and fuel, we change the form of it, things move through membranes, and we oxygenate our blood – that's how nature works. Most industry is built on brute force: you start a process by increasing pressure or temperature. Nature changes free energy states much more gently, and, as a result, much more efficiently. So the next century is going to see a shift toward electrochemical processes and away from temperature and pressure systems."

REDESIGNING CARS

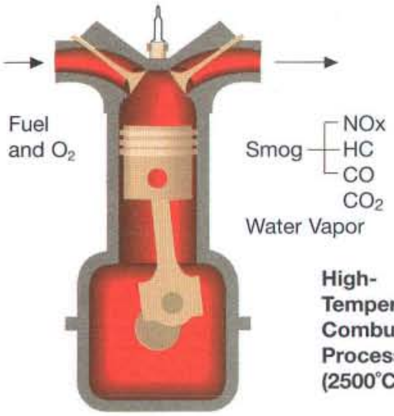
At the core of fuel cell activity is Ballard, a 325-employee company that has contracts with eight of the world's nine largest car manufacturers. (The lone exception, Toyota, is thought to be spending more than $700 million a year to develop alternative-fuel cars in-house.) Ballard is positioning itself as the Intel of the fuel cell industry: just as the Silicon Valley giant tapped a vast market by providing microprocessors for many computer brands, the Canadian firm hopes to build fuel cells for a virtually unlimited array of electrical products. Financial markets like Ballard's prospects: though the company still has no significant earnings, its stock is worth about six times what it was when the company went public three years ago.

Founded in 1979 as a contract research and development firm focusing on lithium rechargeable batteries, Ballard switched to fuel cells when funding for battery projects dwindled in the early 1980s. General Electric developed PEM fuel cells for the Gemini space program in the early 1960s, but when NASA found a related technology with superior characteristics for space applications, it shelved work on PEM fuel cells, and GE's patents in the field eventually lapsed.

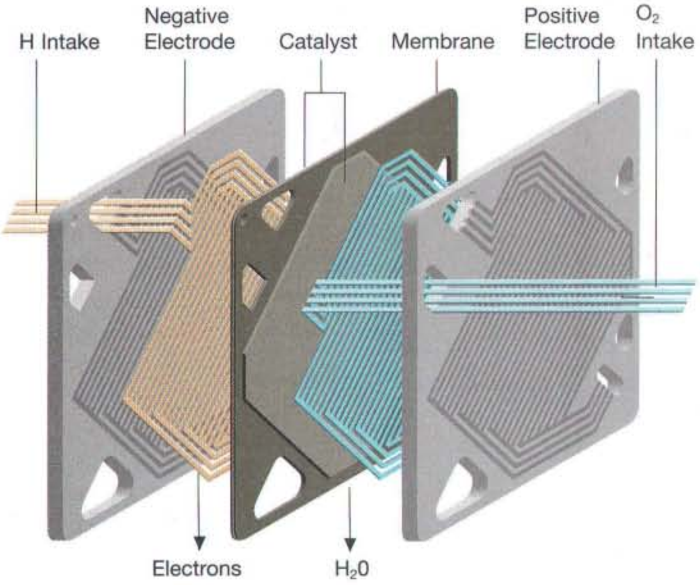
At the prompting of Canada's Department of Defense, which was searching for an unobtrusive field generator, Ballard took up where GE left off and made rapid advancements in intensifying PEM fuel cells' power potential.

Along the way to leadership in the technology, Ballard got a couple of big breaks. One was a series of discoveries in the early 1990s by researchers at Los Alamos National Laboratory in New Mexico. Until then, PEM fuel cells had been considered too expensive for mass production because their catalysts required a substantial amount of costly platinum, but the Los Alamos scientists found a way to reduce the necessary platinum by a factor of 40. Suddenly, it was conceivable that fuel cells could compete with ICEs. Paul Lancaster, my Ballard tour guide, denies that the Los Alamos discoveries aided the Canadian firm, but Shimshon Gottesfeld, the laboratory's project leader, says Ballard officials visited Los Alamos regularly and showed deep interest in the lab's findings.

Equally important, the California Air Resources Board (CARB) decided in 1990 to stimulate development of



High-Temperature Combustion Process (2500°C)



Low-Temperature Electromechanical Process (85°C)

Fire vs. Water; Cool vs. Hot

The traditional internal-combustion engine (ICE) runs on high-temperature explosions – fuel is burned, producing heat, which is then converted into energy.

In contrast, most fuel cells rely on relatively cool electrochemical reactions: hydrogen feeds into the cell through channels on the flow field plates, and a platinum catalyst ionizes the gas, splitting each molecule into electrons and protons (hydrogen ions). The protons pass through a membrane to combine with oxygen on the other side, producing water. The electrons, which cannot pass through the membrane, are channeled along an external route and harnessed to power an electric motor.

The fuel cell process is two to three times more efficient than that of an ICE, *and* its only by-products are electricity, water, and a moderate amount of heat.

DIAGRAMS: BALLARD

nonpolluting cars by requiring that zero-emission vehicles comprise 2 percent of annual statewide car sales by 1998 and 10 percent by 2003. Though CARB had battery-powered electric cars in mind, the batteries' weight, uncertain durability, and short range have stymied the cars' development. Fuel cell developers, however, were galvanized. Consultant Sandy Thomas says bluntly, "Without the zero-emissions program in California, I wouldn't have a job." When CARB dropped its 1998 requirement last year because battery-powered car development had stalled, Thomas and most other fuel cell advocates were relieved, since fuel cell cars now had five more years to prove themselves.

How can we avoid an asthmatic future of smog-filled urban landscapes, and create a world as pristine as an Evian commercial?

Automobile exhaust is one of the world's largest sources of air pollution, causing more than 60 percent of air pollution in urban areas.

The fossil fuels that power our cars also generate 20 percent of the nation's emissions of carbon dioxide, the most significant greenhouse gas.

If the US vehicle fleet switches from internal-combustion engines burning fossil fuel to fuel cell engines using hydrogen derived from renewable sources, both kinds of car emissions would drop to zero.

The most vexing issue developers face is the selection of fuel to deliver hydrogen to fuel cell engines. It's a choice with huge environmental implications. Automobile emissions cause more than 60 percent of air pollution in urban areas.

The Harvard School of Public Health estimates that in the US alone, one kind of car emissions - fine particulates - causes 50,000 to 60,000 deaths a year; several other types of vehicle emissions are also thought lethal, but no mortality estimates exist for them. In addition, automotive use of fossil fuels accounts for 20 percent of the nation's carbon-dioxide emissions, the most significant greenhouse gas. If the US vehicle fleet switches from ICEs burning fossil fuel to fuel cell engines using hydrogen derived from renewable sources - which may be possible within several decades - levels of both kinds of car emissions would drop to zero. Even if the hydrogen is produced from natural gas, as is common now, vehicular air pollution would end and greenhouse-gas emissions would drop by more than 60 percent.

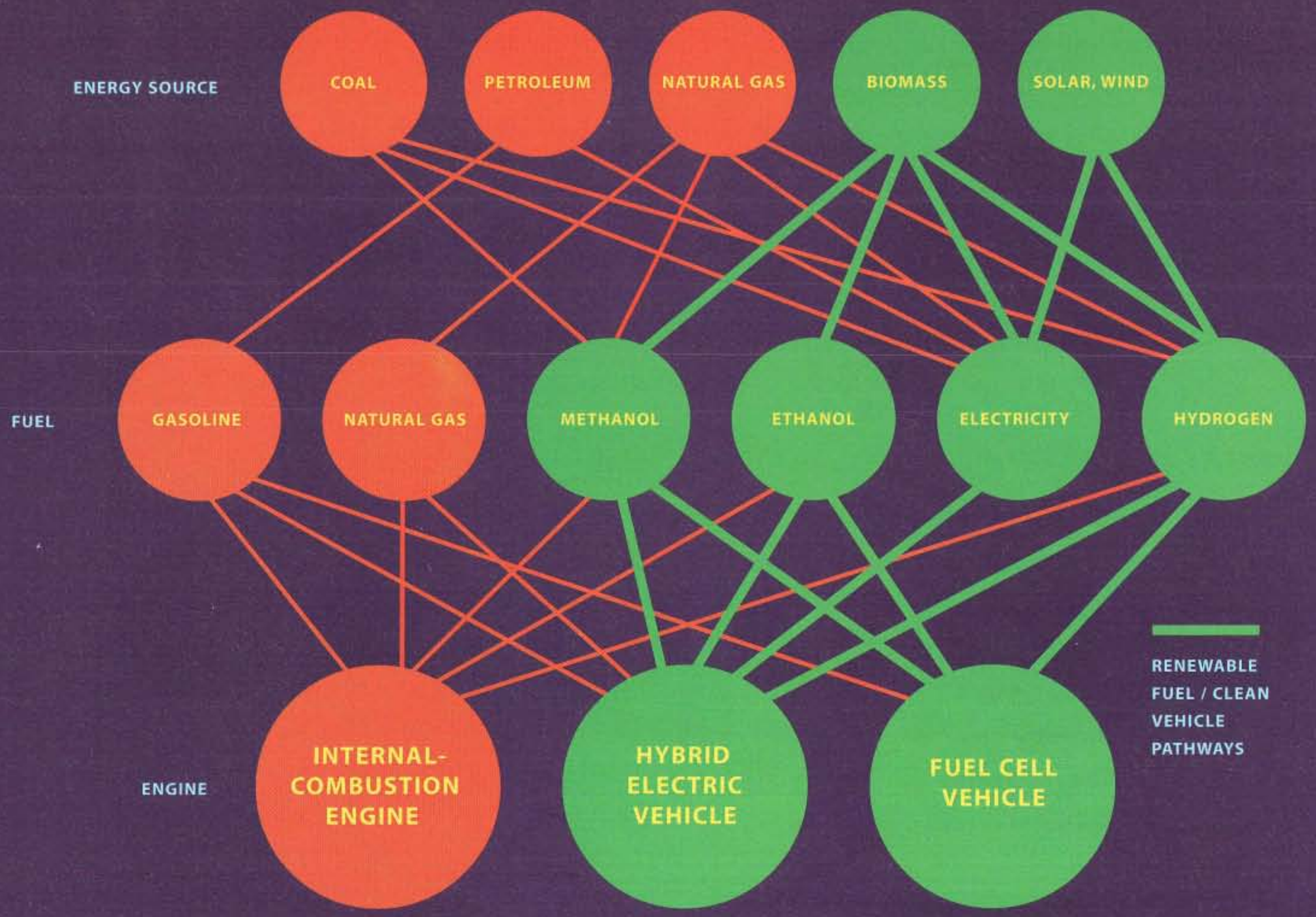
The global consequences are even more extreme. The DOE estimates that in a mere 20 years - from 1995 to 2015 - the demand for energy will grow by 54 percent worldwide and by 129 percent in developing Asia. China and India, the world's two most populous nations, are expected to satisfy an exploding demand for energy by tapping vast reserves of coal, among the dirtiest of fossil fuels; it is widely assumed that the pollution and climactic impact of such developments will be grave. The advent of hydrogen not only poses a dramatically cleaner alternative, but also offers developing countries a chance to bypass at least part of the expense of building a fossil fuel infrastructure just as industrialized countries are poised to turn to more advanced technologies.

Yet shifting to hydrogen-powered fuel cell cars will not be easy. True enough, hydrogen is already used in all sorts of processing, from the hardening of fats and oils - hydrogenation - to, ironically enough, oil refining. But hydrogen, like gasoline, must be manufactured: it bonds so easily with other elements that it doesn't exist naturally on Earth in pure form. The trouble is that while gasoline is sold in 200,000 filling stations across the US, the hydrogen infrastructure is minuscule. The result is a chicken-and-egg dilemma: What manufacturers will market hydrogen-powered cars if hydrogen isn't available to drivers? What hydrogen producers will build more plants if hydrogen cars aren't on the road? And without hydrogen fuel, who will buy hydrogen-powered cars?

Hydrogen's problems don't end there. Though most experts believe that the element is at least no more dangerous than gasoline, the public perception, based on memories of hydrogen-bomb tests and accounts of the 1937 *Hindenburg* airship crash, is that it's extremely unsafe. More worrisome, hydrogen can't easily be stored in a car. If it's stored as a compressed gas using current technology, the amount required to provide the range equal to 15 gallons of gasoline takes up four times as much space and weighs twice as much as a filled gas tank. If it's liquefied, it must be kept below -423 degrees Fahrenheit, just 36 degrees above absolute zero. Both the safety and storage problems are considered surmountable, but they have discouraged some car manufacturers from embracing pure hydrogen fuel.

A transitional solution may lie in fuel cells' flexibility: they can run on any hydrogen-rich fuel, including gasoline. Chrysler, in fact, is developing a "fuel-flexible" fuel cell engine that can run on a variety of fuels, from gasoline to hydrogen. The engine will include a reformer that can convert gasoline and other fuels to hydrogen, neatly bypassing hydrogen's infrastructure and storage problems. The trade-off is in efficiency and environmental benefits. The Union of Concerned Scientists estimates that a fuel cell car using gasoline would provide at best 1.5 to 2.3 times higher fuel economy than the same ICE car burning gasoline, while a fuel cell car running on hydrogen scores 2.8 times the gasoline-powered car's performance. Emissions of pollutants by fuel cell cars running on gasoline would drop substantially but would not equal the zero level of hydrogen-powered fuel cell cars. Chrysler's success may hinge on its ability to devise a gasoline reformer small and efficient enough to be placed inside a car. Sandy Thomas calls that job "an extraordinarily difficult technological challenge" comparable to installing

CHART: UNION OF CONCERNED SCIENTISTS



The Right Source + The Right Fuel + The Right Engine = Less Pollution

This chart shows the complexity of energy choices prompted by the emergence of fuel cell vehicles. An array of fuels can power vehicles, but it's the combination of energy source and fuel that determines the environmental and geopolitical impact. The energy source largely determines energy independence and the impact on global warming, while the fuel roughly dictates the extent of tailpipe emissions. For example, since the conversion of natural gas to hydrogen produces significant carbon dioxide, this combination creates more than three times as much greenhouse gas as methanol produced from biomass. But hydrogen and electric power are the only fuels that offer the prospect of zero-emission vehicles.

The least known and perhaps most intriguing energy source is biomass, which includes "power crops" such as fast-growing trees and grasses, as well as organic residues from sawdust to sewage. Though biomass already provides about 2 percent of the nation's electric-power supply, estimates of its potential contribution range up to three-quarters of US electricity consumption, or, alternatively, all fuel used by US passenger vehicles. Because it is not economical to transport raw biomass more than 50 miles before converting it to fuel, small, local, and conceivably self-sustaining energy centers would emerge in the future.

Solar and wind energy also can be used to generate electricity that in turn splits water into hydrogen and oxygen through electrolysis. The fondest dream of many hydrogen advocates, electrolysis eliminates emission of all pollutants and greenhouse gases while promoting energy independence. Unfortunately, the process is markedly expensive and unlikely to be economical for widespread use for many decades.

The renewable pathways (shown in green) are the most beneficial. One reason is that renewable sources produce less greenhouse gas than fossil fuels. Though biomass does contain carbon, which forms carbon dioxide during fuel conversion, the use of biomass as an energy source adds no net CO_2 to the atmosphere – it merely returns the carbon it extracted from the atmosphere during its growth. In addition, renewable sources promote energy independence and decentralization and needn't run out until the sun is extinguished, about 5 billion years from now.

a miniature oil refinery in a car to convert crude oil to gasoline.

Daimler-Benz has opted for a middle path, choosing methanol as its fuel. Methanol is usually produced from natural gas, but it can also be derived from feedstocks as diverse as coal and renewable plant material. Like gasoline, methanol requires an onboard reformer, but its fuel economy, 2.5 times that of an ICE using gasoline, is higher, and its emissions are lower. Methanol's biggest advantage is that it's a liquid at room temperature, which means that it can be transported and handled much more easily than gaseous hydrogen. However, it, too, suffers from a small infrastructure.

Ford's fuel choice is the most daring and potentially most beneficial choice: hydrogen. Ford is banking on the validity of studies by Sandy Thomas and Joan Ogden, a Princeton researcher, suggesting that hydrogen's infrastructure problem could be solved by using excess refinery hydrogen and supplying filling stations with reformers capable of converting natural gas to hydrogen. These reformers probably would be much more cost effective than the ones Chrysler wants to install inside cars: they would not have to meet onboard miniaturization and durability requirements, and they could operate nearly constantly, serving all of the cars that patronize a given filling station. Once demand for hydrogen grows to a substantial level, hydrogen refiners presumably would be prepared to build additional plants. To cope with the hydrogen-storage problem, Ford has designed a car that is similar in performance and safety to a Taurus but with an aluminum body and other lightweight features. Weighing only 2,000 pounds – compared to a Taurus's 3,300 – Ford's car can travel farther on less fuel, meaning that less hydrogen needs to be stored onboard.

"The information revolution and the coming energy revolution are similar in that we are using human ingenuity to replace energy and raw materials," says Joseph J. Romm, a top US Department of Energy official.

"Both revolutions represent a fundamental transition to a world in which we are not resource constrained, yet we have a higher standard of living."

Ford's solution understandably has gained the support of some environmentalists, who fear that if Chrysler or Daimler-Benz succeeds, the incentive to move to fuel cells using hydrogen from renewable sources would disappear. Chris Borroni-Bird, an advanced-technology specialist at Chrysler, disagrees. "If you can commercialize fuel cells in the first place by using gasoline, there will be an inexorable trend toward cleaning up the fuel, because that will improve vehicle performance."

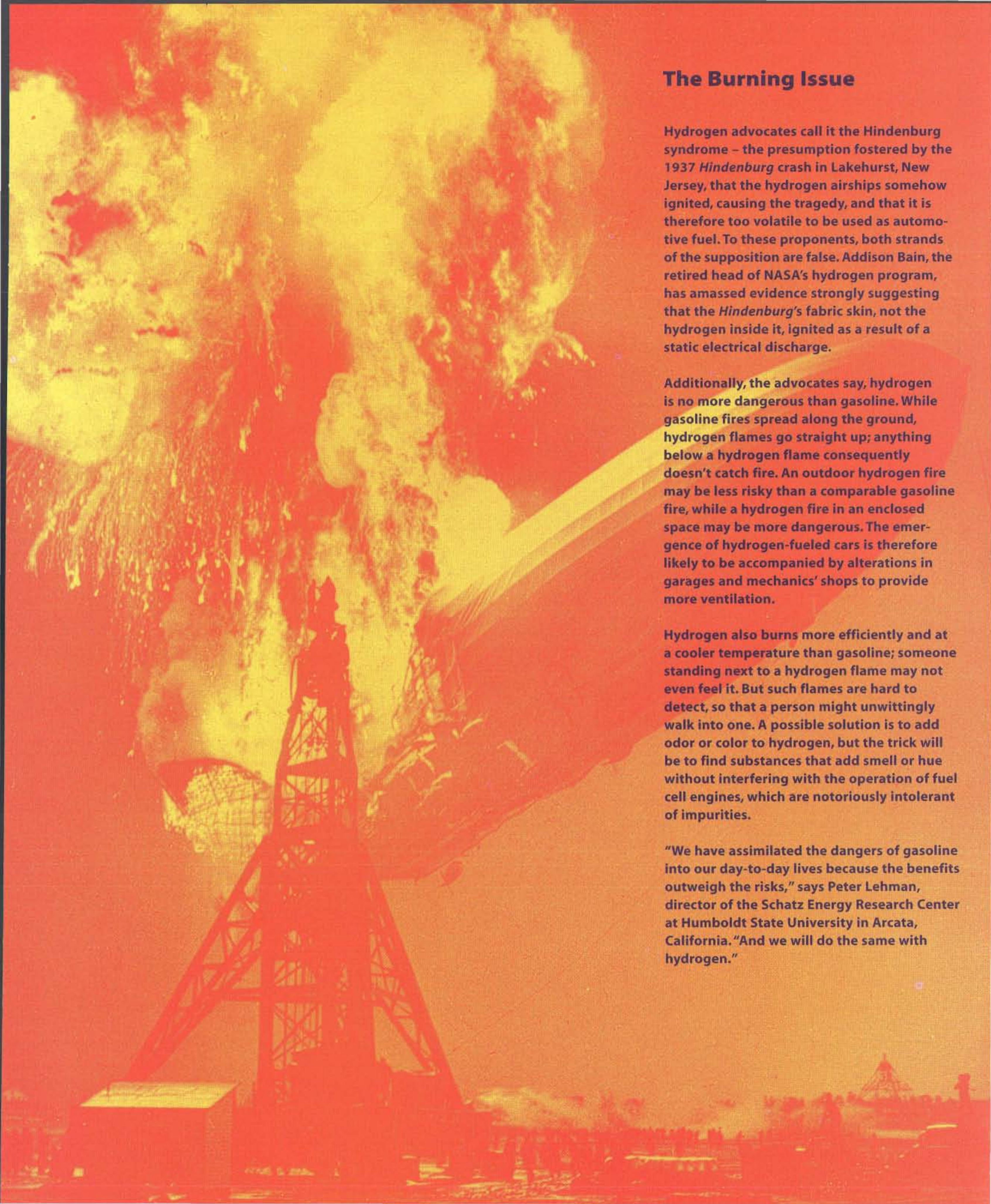
From an environmental perspective, the best transitional fuel may be the one that leads most quickly to the use of fuel cells using hydrogen from sustainable sources. "No matter which fuel we use in the near term, we need to keep our eyes on the prize: that it's a renewably powered fuel cell vehicle that ultimately deals with transportation challenges," says Jason Mark, a transportation analyst at the Union of Concerned Scientists. "A gasoline fuel cell is at best a stepping-stone to something better. It's my hope that it becomes only a stepping-stone and not a roadblock."

Of course, a major innovation in the nascent field of fuel cell technology could upset these calculations. One possible example is the claim announced last December by researchers at Northeastern University in Boston. They say they used graphite nanofibers to increase current hydrogen storage capabilities by a factor of 10. If true, the discovery means that a car could travel 5,000 miles on a single hydrogen cartridge; the empty cartridge could then be recharged or exchanged for a full one. Since a filled cartridge could potentially be delivered to the driver, there would be no need to establish a hydrogen infrastructure, and the two greatest obstacles to use of hydrogen – lack of infrastructure and onboard storage problems – would be removed. However, many specialists are skeptical of the Northeastern claim, particularly since the researchers have not revealed enough information to allow outsiders to confirm their findings. "If it works, it's going to change everything," says Robert H. Williams, a senior scientist at Princeton. "We don't know if it's going to pan out, but I think it shows that if we take hydrogen seriously, there are all kinds of surprises in store for us."

Meanwhile, Ballard is providing fuel cells for all three kinds of engines – for Chrysler, Daimler-Benz, and Ford. Accordingly, Ballard is agnostic in the fuel dispute: its chief hope is that one of the strategies works, enabling the company to ride the technology's success to riches. To reinforce its position, Ballard has secured 91 patents, with another 104 pending; together, these patents cover 61 inventions.

Ballard still faces competition from major US oil, electronics, and chemical companies – Exxon, ARCO, AlliedSignal, Motorola, 3M, and DuPont all have launched their own fuel cell-related programs. Many of these companies investigated the technology in the 1960s and 1970s and gave up; now, with interest in fuel cells renewed by the Los Alamos discoveries and deepened environmental concerns, they have gotten back in. Last May, Delphi Energy & Engine Management Systems, a General Motors division, announced an alliance with Exxon and ARCO to develop an onboard-vehicle processor to extract hydrogen from fossil fuels such as gasoline and methanol. John Robbins, Exxon's program manager, declines to say whether the oil company foresees shifting from marketing fossil fuels to selling pure hydrogen if a

PHOTO: UPI/CORBIS-BETTMAN



The Burning Issue

Hydrogen advocates call it the Hindenburg syndrome – the presumption fostered by the 1937 *Hindenburg* crash in Lakehurst, New Jersey, that the hydrogen airships somehow ignited, causing the tragedy, and that it is therefore too volatile to be used as automotive fuel. To these proponents, both strands of the supposition are false. Addison Bain, the retired head of NASA's hydrogen program, has amassed evidence strongly suggesting that the *Hindenburg*'s fabric skin, not the hydrogen inside it, ignited as a result of a static electrical discharge.

Additionally, the advocates say, hydrogen is no more dangerous than gasoline. While gasoline fires spread along the ground, hydrogen flames go straight up; anything below a hydrogen flame consequently doesn't catch fire. An outdoor hydrogen fire may be less risky than a comparable gasoline fire, while a hydrogen fire in an enclosed space may be more dangerous. The emergence of hydrogen-fueled cars is therefore likely to be accompanied by alterations in garages and mechanics' shops to provide more ventilation.

Hydrogen also burns more efficiently and at a cooler temperature than gasoline; someone standing next to a hydrogen flame may not even feel it. But such flames are hard to detect, so that a person might unwittingly walk into one. A possible solution is to add odor or color to hydrogen, but the trick will be to find substances that add smell or hue without interfering with the operation of fuel cell engines, which are notoriously intolerant of impurities.

"We have assimilated the dangers of gasoline into our day-to-day lives because the benefits outweigh the risks," says Peter Lehman, director of the Schatz Energy Research Center at Humboldt State University in Arcata, California. "And we will do the same with hydrogen."

transition to a hydrogen economy occurs, but Patrick Grimes, an energy consultant and former Exxon researcher, says, "The oil companies are in the fuel-providing business, and they'll provide any fuel that enough people want to buy."

The biggest imponderable in the future of fuel cell vehicle technology may be its ultimate cost. A 1994 study prepared for the US Congress's Office of Technology Assessment estimated that these cars would cost $4,000 to $7,000 more than comparable ICE cars. Sandy Thomas believes that in early production runs, Ford's hydrogen-fueled cars will cost no more than $1,500 to $2,000 above their ICE equivalents. Paul Lancaster maintains that Ballard and Daimler-Benz together know how to design cars that will carry no premium at all.

Given the current unwillingness of car buyers to pay a higher sticker price for greater fuel economy and lower pollution, the projection by Ballard/Daimler-Benz may have to be correct if fuel cell-powered cars are to catch on. Lancaster believes that a combination of technological advances and economies of scale from mass production will make fuel cell engines competitive. For example, even though Ballard has already reduced the amount of platinum in its engines by 90 percent, Lancaster says the company is already testing another tenfold drop in the platinum load. Its researchers have also found significantly cheaper ways to produce the engine's membrane and the graphite plates surrounding the membrane, he says.

"Power plants are going to be just like furnaces," says Joe Maceda of Power Technologies. "They're going to be appliances."

If Ballard's projections are accurate, the expected financial benefits of owning a fuel cell car - lower maintenance costs because of the absence of moving parts and lack of need for oil changes and smog checks - will be a bonus.

TRANSFORMING THE UTILITIES MARKET

Just as environmental regulations stimulated fuel cell vehicle technology, deregulation is about to do the same thing for fuel cell power generation. Specifically, the impending deregulation in the electric-utility industry will create many opportunities for fuel cell power plants, which will reach market years before fuel cell cars. Recent legislation has ended utilities' monopolies in many respects, enabling consumers to buy electricity from remote providers. As a result, the established practice of building huge central power plants in anticipation of future demand, while reflecting their construction costs in current electric rates, may no longer work.

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PHOTO OF BALLARD POWER PLANT: KAREN MOSCOWITZ

Crack Pots

Once upon a time, before there was television or the Internet, painted vases told stories. Italian architect/designer Marco Zanini hasn't forgotten.

A longtime collaborator of Ettore Sottsass and a founding member of the postmodern design group Memphis, Zanini is concerned with the ever-accelerating pace of modern life. As an antidote, he says, "I thought it would be nice to start telling stories – even contemporary stories – the old, slow way with ceramics."

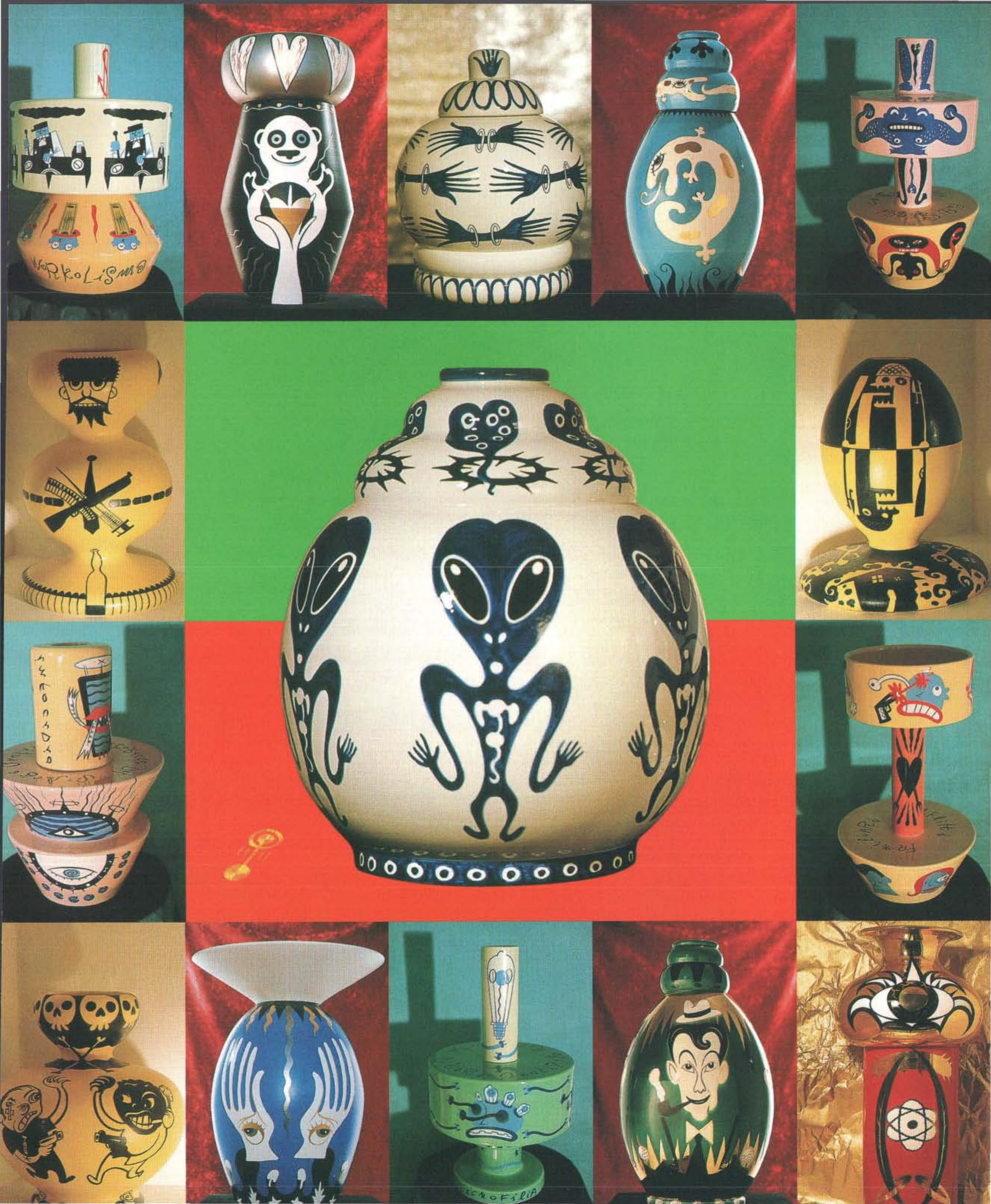
Zanini and artist Massimo Giacon identified contemporary subjects, such as new mythologies and contemporary wars, and treated them with modern iconography, all the while using classic ceramic techniques such as the Greek two-colors and Chinese blue-and-white to tell their tales.

Some subjects are picked from the news of the day, such as *Dossier Roswell* (center). Others are more profound in their sociological or philosophical thinking. But in the end, as Zanini himself points out, "these are just ceramic vases to hold water, and, hopefully, some flowers."

Manufactured by Bitossi in Montelupo, Italy, Zanini's Ceramicomix are available at Galleria Inter Nos, Milan: +39 (2) 890 0632. – *John Plunkett*

John Plunkett* (johnp@wired.com) *is* Wired*'s creative director.

PHOTOGRAPHY: DONATELLA BRUN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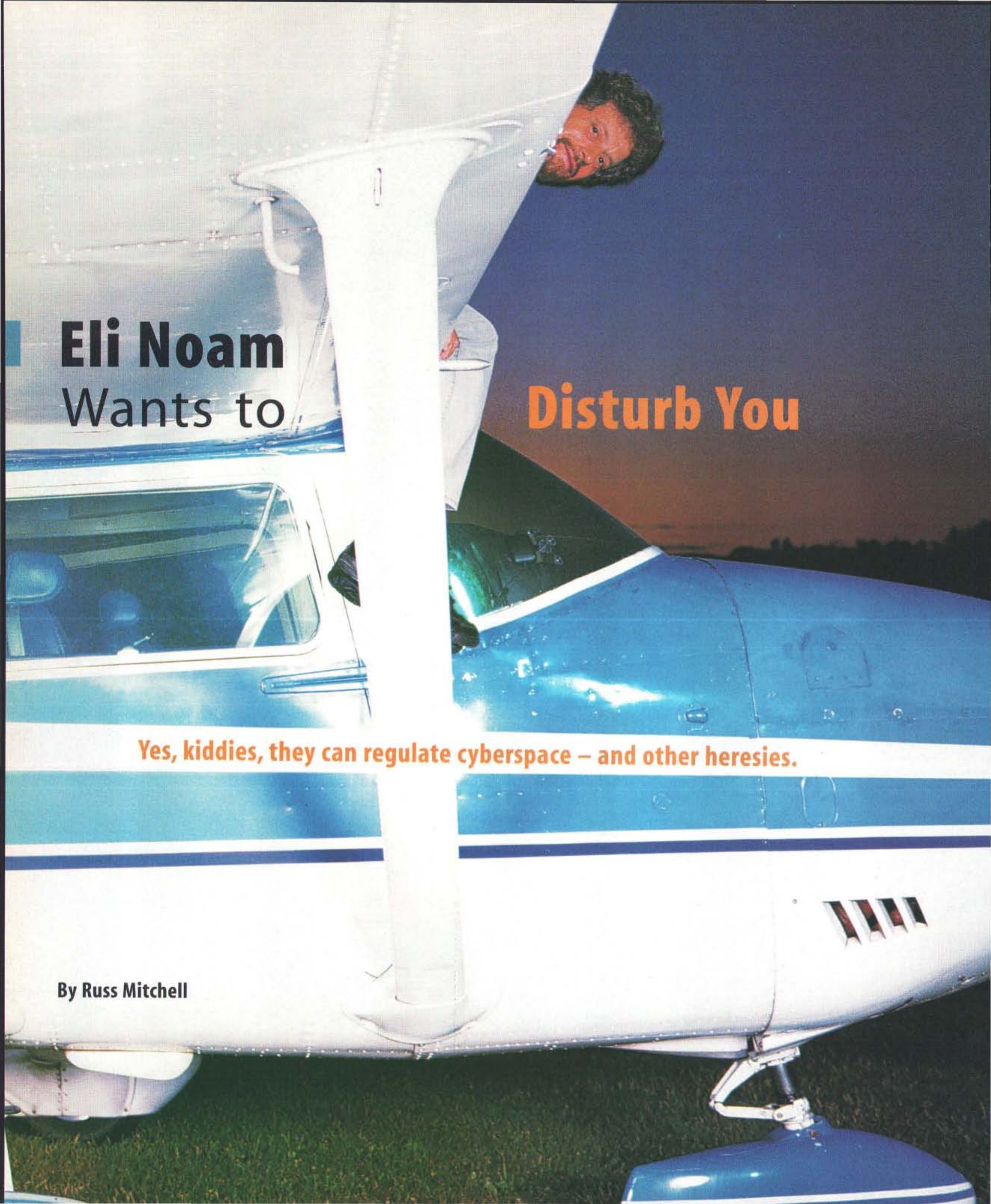

Eli Noam Wants to Disturb You

Yes, kiddies, they can regulate cyberspace – and other heresies.

By Russ Mitchell

Wired: You've talked about a collection of media critics you call the Cassandra Industry, and you say that they're a lot more dangerous than we might think.

Noam: There is a fear of a fragmented, decentralized, chaotic, uncontrollable environment. Computers have always been this mysterious force, and people read into them their fears and hopes. In the past there was this *1984*-style notion of Big Brother, that all data will be centralized and controlled by the government. That model was replaced by the hacker scenario, where 14-year-olds could start nuclear wars on their own. As usual, the protection of children is being brought into the argument. And the complaint is that there is *not enough* government control.

A similar shift hit television. There was the notion of the lowest common denominator and bland mass culture. Television started to fragment into dozens, then hundreds, of channels; now critics are lamenting the loss of a common denominator and the electronic hearth around which everybody congregates. And it's the same people complaining!

The computer communications media have actually had a pretty good run. They haven't been ganged up on yet in quite the same way, perhaps because of a certain fascination, but I expect that this will no doubt happen - you see those manifestations already in issues like the Exon amendment.

But doesn't the Net route around regulation?

The notion that you cannot regulate the Internet is the wishful thinking of technologists. The Internet will create winners, and, precisely because it is so effective, many losers - and the losers will tend to be established, organized institutions.

If you think of the Internet as electronic content, it is very difficult to regulate. But there are physical manifestations, physical networks. Governments will grab those factors that are less mobile. You will always be able to regulate phone companies, because they've got central offices, networks. What about these satellite companies? Teledesic is owned by people. One of them is Bill Gates. You can go after Bill Gates.

The Telecommunications Act of 1996 didn't take us very far toward the more open regulatory environment you champion.

The '96 act has been vastly oversold to the public by various politicians and lobbyists trying to grab credit. It's not the cause of change, it's the result of change. The act establishes a fairly detailed regulatory régime. In many respects it regulates in order to deregulate; everything is supposed to be transitional to competition. I happen to live in New York under a transitional régime of rent control. It was supposed to deal only with a housing emergency following World War II. It's still around.

Russ Mitchell is a senior writer for U.S. News & World Report.

You'd like to see a freer market in spectrum auctions.

In the past, frequencies were granted by government to parties who had the best lawyers or had the most influence. More recently, the government started to auction off frequencies. This is still based on the concept of real estate, which you own. I find it better to think of spectrum in terms of paying for access rights. You have to pay only for the usage. It's also, in constitutional terms, the correct solution: I believe the government has only the right to prevent collisions of users of frequencies, rather than selling the rights to use the ether. Airplanes fly between cities without having to pay for air space. The airlines bid for landing gates.

You're talking about a spectrum commodities exchange.

If somebody wants to buy access, they would buy it in a spot market or a futures market. There would be a limited number of access codes issued by a clearinghouse of spectrum users, and they would then be traded among brokers. The technology is not the main problem with implementing this. It's economic interests, political inertia.

How would consumer prices work?

They could be higher for the congestion periods, and lower in low-congestion periods. Under a futures exchange, they should be lower, because it would be more difficult to maintain a cartel that establishes high prices. You see the reverse in the price of digital cellular service, where prices were bid up by the current auction system, which treats spectrum like property.

Banking is another entrenched industry you say will be transformed as digital information pushes governments toward freer markets.

The banking system will be transformed in major ways. We'll have private monies. Governments will be out of the business of monetary policy; they will be competing in global currency. If there is a role for government, it's more likely to be quality control, consumer protection.

Government's control over money is important if there is one currency and one inflation rate. But if you have multiple currencies, there will be multiple inflation rates, and people will pick and choose those monies they want to be in.

Look what happened to the phone companies. There was a notion that for a society to have communications, you needed Ma Bell and a clear regulatory system. The idea of multiplicity and diversity, of people shifting in and out - that competition and choice would govern - was hard to swallow.

People feared chaos. Chaos didn't happen. ■ ■ ■

Tell Eli (rhymes with telly) Noam he's prolific, and he paints himself as something of a slouch. Sure, he's authored or edited 17 books and is about to publish six more. But, he protests, "if I'd been so prolific, these two volumes would have been finished by summer." Israeli-born Noam (who simultaneously earned a law degree and an economics PhD from Harvard) heads the Columbia Institute for Tele-Information, which, simply put, studies mass media. Noam's politics and economics follow a free-market bent, but he's no ideologue. He's a former head of the New York State Public Service Commission and has served on advisory boards for the IRS and other government bodies. No doubt, his advice has disturbed many a bureaucrat.

PHOTO: CHRIS BUCK

Map the Genome, Hack the Genome

By Michael Gruber

The bright, confident, serious people creating the biotech industry
are the fathers and mothers of something enormous.
And in their ordered way, they are immensely more scary than the most
anarchic cyberpunk hacker ever born.

They are laying the groundwork for what Bruce Sterling calls, chillingly, the posthuman.

Illustrations by Anastasia Vasilakis

The news that an obscure animal husbandry lab in Scotland has cloned a sheep – that is, generated a mammal from a body cell without sex – caused quite a stir, since naturally the first thing everyone thought was, Now they can clone people. There followed the usual political posturing, including a ban by President Clinton on federal funding for cloning people (not exactly a major field), followed by clonist Ian Wilmut's earnest protestations that all he wanted was a better, more genetically engineerable sheep, and that he had no intention of

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Michael Gruber (mag@well.com) *is a Seattle-based writer.*

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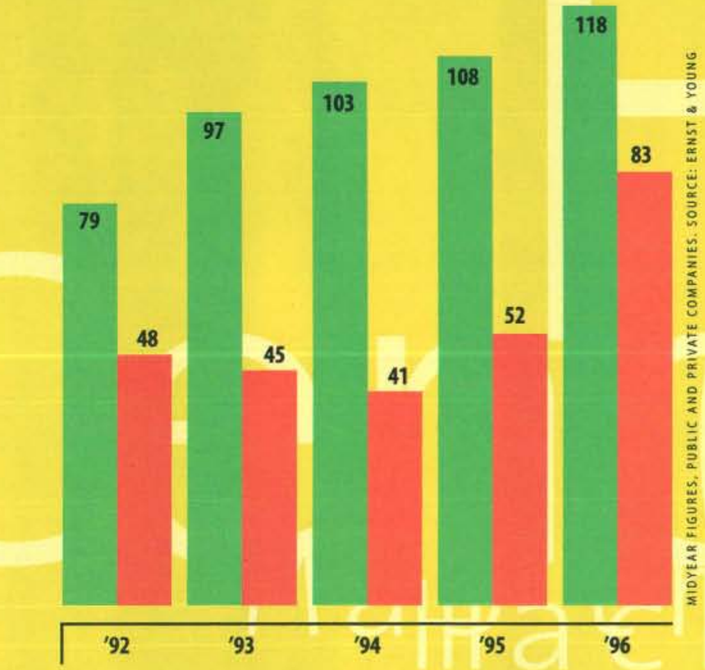
Early Days

The biotech industry is a US$83 billion toddler. How big will it be when there is a biobox and gene splicer in every house?



MIDYEAR FIGURES, PUBLIC AND PRIVATE COMPANIES. SOURCE: ERNST & YOUNG

cloning people, as That Would Be Wrong.

But out on the biotech frontier, the news brought mostly shrugs. Out there, people aren't interested in cloning – a clunky, mechanical matter to those who dwell among the intimate details of life, down where the nucleotides and the proteins play. *Anyone* could have done it. And besides, where's the payoff? They are not like us, people on the biotech frontier. But they're not like other kinds of frontierspeople, either.

Look at it this way: every frontier has its own kind of cowboy, but they are mainly variations on a theme. The itinerant printers who wandered Europe when movable type was the cutting edge, the iron and steam masters who made the Industrial Revolution, the people who built and ran the first railroads, the hot-fist telegraphers, the folks in goggles and leather jackets who created aviation, the outlaw hackers and the whiz kids of Silicon Valley – all had, and have, certain essential qualities.

They delight in the mastery of new and powerful skills and the manic energy this can convey. They're impatient with existing establishments, with conservative nervousness about the shock of the new. They seek a limitless El Dorado based on technical wizardry. They speak in their own cant and despise restraint. Their country is the future – which today means biotechnology. Biotech will be to the coming century what electronics has been for the one now passing. Everyone says that. So where are the cowboys?

This is what I went looking for at the second annual After the Genome conference, where biotech revolutionists come to show-and-tell, schmooze, and deal. It's November, and margaritas are flowing by the bucketful in the lounge of Santa Fe's Bishop's Lodge. Every time you turn around, a waitress in an off-the-shoulder Mexican blouse places another half-pint glass of pale green slush in your hand. Amid all the Southwestern kitsch – saints in mesquite, bowls, baskets, rugs, and paintings of spiritual Native Americans and sunset landscapes – 80 people are getting mildly stoned and scarfing up guacamole and canapés.

The drinks and food are free, paid for by the drug companies – the pharmas. It's like Vegas, except there's more money at stake. Lots more money. The pharma guys look like everyone else, sweaters and jeans, everything academic-casual. A little sloppy, but not nerdy, is the desired effect, except that they stick together in little groups and eye one another warily. Pharmaceuticals are a US$110 billion-a-year business in the United States alone, bigger than the software industry – and none of that is games.

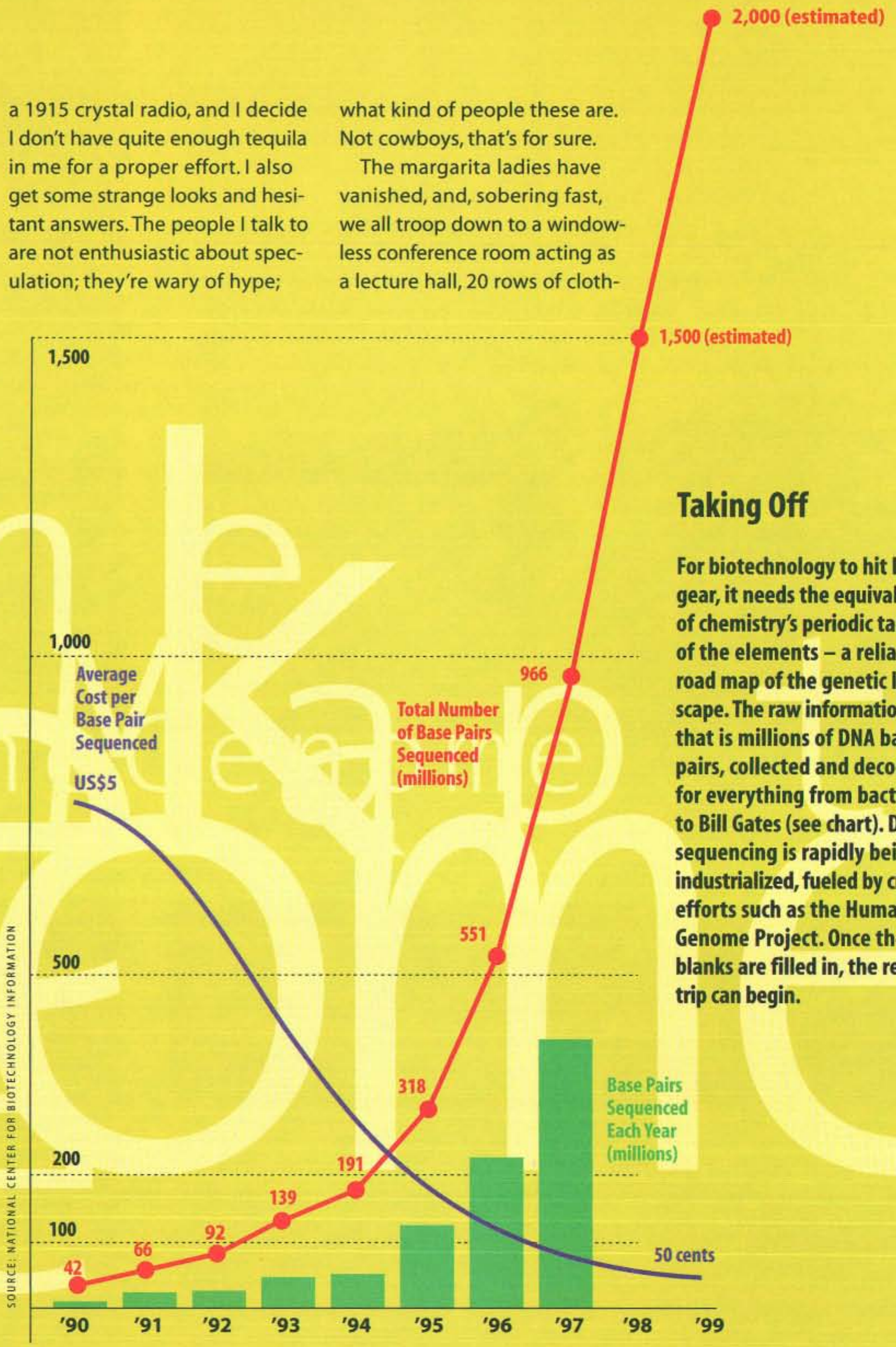
Journalistic ethics prompt me to do some work before I'm too drunk to stand up, so I go over to conference organizer Roger Brent of Harvard's med school. You could easily mistake Brent for the character Jeff Goldblum played in *Jurassic Park*. The glinting specs and the black garb are the same, as is the nonstop, mind-boggling monolog. I ask Brent how he chose the conference title, and he explains that it's a riff on Neil Young's *After the Gold Rush*. In other words, the people here are engaged in what – until we reach other planets – may be the last great exploitation of a natural resource, and the economics are the same. Vanderbilt-scale fortunes are going to be built, because, as Brent explains, there are just so many genes, just as there were just so many gold mines and railroad routes and furry animals in the early days of the American West.

The Human Genome Project, a federally funded effort to establish the DNA sequence and map every gene in the human body – the largest biology enterprise ever launched – is supposed to be finished early in the coming century, and it's right on schedule. The human genome (i.e., the totality of our genetic information) contains an estimated 100,000 genes. Of these, about 5,000 code for the critical blood-borne proteins likely to be the prime targets for manipulation by drugs. Once these are grabbed, there ain't no more.

Grabbed? How can something in every human body on the planet be *owned*? Oh, not the gene itself, Brent explains – the gene itself is nothing but a long string of letters. That's in the public domain, and you can download it off the Internet. It's what the gene does that's important, and how to manipulate that – that's the art, and an art can be patented, in the form of a drug or a technology.

So here is the big problem with the widely heralded Human Genome Project: just knowing the sequences of all those millions of base pairs – the building blocks of DNA – does you as much good as knowing where all the tiny pits are on a compact disc. Without detailed understanding of how those pits translate into music or software, you don't have a product. Nearly all the people here are involved in one way or another in efforts to do just that – to go from tiny pits to music, from code to salable commodity. And that's why *genomics*, not *plastics*, is the word to whisper in today's graduate's ear.

Circulating through the crowd, I stop at various groups and ask an unscientific sample of scientists the following question: It's just 100 years since Marconi sent the first radio message and launched an electronic revolution that has completely transformed the world; applying that same time frame to biotechnology, what year are we in now? The consensus is somewhere between 1905 and 1915. I try to think of a biotechnology as far advanced over what we can do today as the electronics in the average modern home is over a 1915 crystal radio, and I decide I don't have quite enough tequila in me for a proper effort. I also get some strange looks and hesitant answers. The people I talk to are not enthusiastic about speculation; they're wary of hype; they're closely focused on the actual, the tools, the little cells. I ask: This is the frontier, boundless horizons – where do you think we'll be in 2050? Blank looks. I sense that I don't quite understand what's going on, what kind of people these are. Not cowboys, that's for sure.



SOURCE: NATIONAL CENTER FOR BIOTECHNOLOGY INFORMATION

Taking Off

For biotechnology to hit high gear, it needs the equivalent of chemistry's periodic table of the elements – a reliable road map of the genetic landscape. The raw information for that is millions of DNA base pairs, collected and decoded for everything from bacteria to Bill Gates (see chart). DNA sequencing is rapidly being industrialized, fueled by crash efforts such as the Human Genome Project. Once the blanks are filled in, the real trip can begin.

The margarita ladies have vanished, and, sobering fast, we all troop down to a windowless conference room acting as a lecture hall, 20 rows of cloth-covered tables and chairs, slide and overhead projectors, a screen. Over the next three days, we will spend nearly 40 hours in this room; the amount of time spent talking intensely in small groups is uncounted, but a lot. Not much of a junket this; the frontiers of science are a serious place.

The first conference speaker is Craig Venter, president and director of The Institute for Genetic Research – called TIGR – based in Rockville, Maryland. Venter, one of the Human Genome Project's prime movers, is talking about the handful of genomes that already have been completely sequenced – those for some bacteria and a yeast. Barely 0.2 percent of the human genome has been fully sequenced. That doesn't sound like much, but the effort has a natural exponential shape – the more we learn, the easier it is to sequence the remainder.

Every frontier has its cowboys. Biotechnology's are different – they are more like priests.

Venter, a tired-looking, preppily dressed man, clearly has given this talk before. As he rattles through his spiel, slides popping on the screen behind him, I realize I am in trouble. Personal disclosure: for various half-forgotten reasons, I picked up a PhD in biology 25 years ago. In preparation for this meeting I read an undergraduate genetics text, and increasingly felt like Rip van Winkle. (Fun facts: Unraveled, the DNA in a typical cell would be a meter long. All the DNA in an average human body would reach from Earth to the Sun and back 50 times. This is the kind of stuff I retain, alas.)

The problem is not concept, but nomenclature. Nomenclature is to molecular biology as mathematics is to physics – a mind-numbing barrier for the lay knowledge seeker. There are so many *things*, in so many different kinds of cells, and each has its own, usually lengthy,

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Figure This

There are two ways to look at this image: One hell of a free-form puzzle. Or five minutes of processing by a Unix workstation, crunching 3,000 assorted stamps to place just the right 594. Your call.

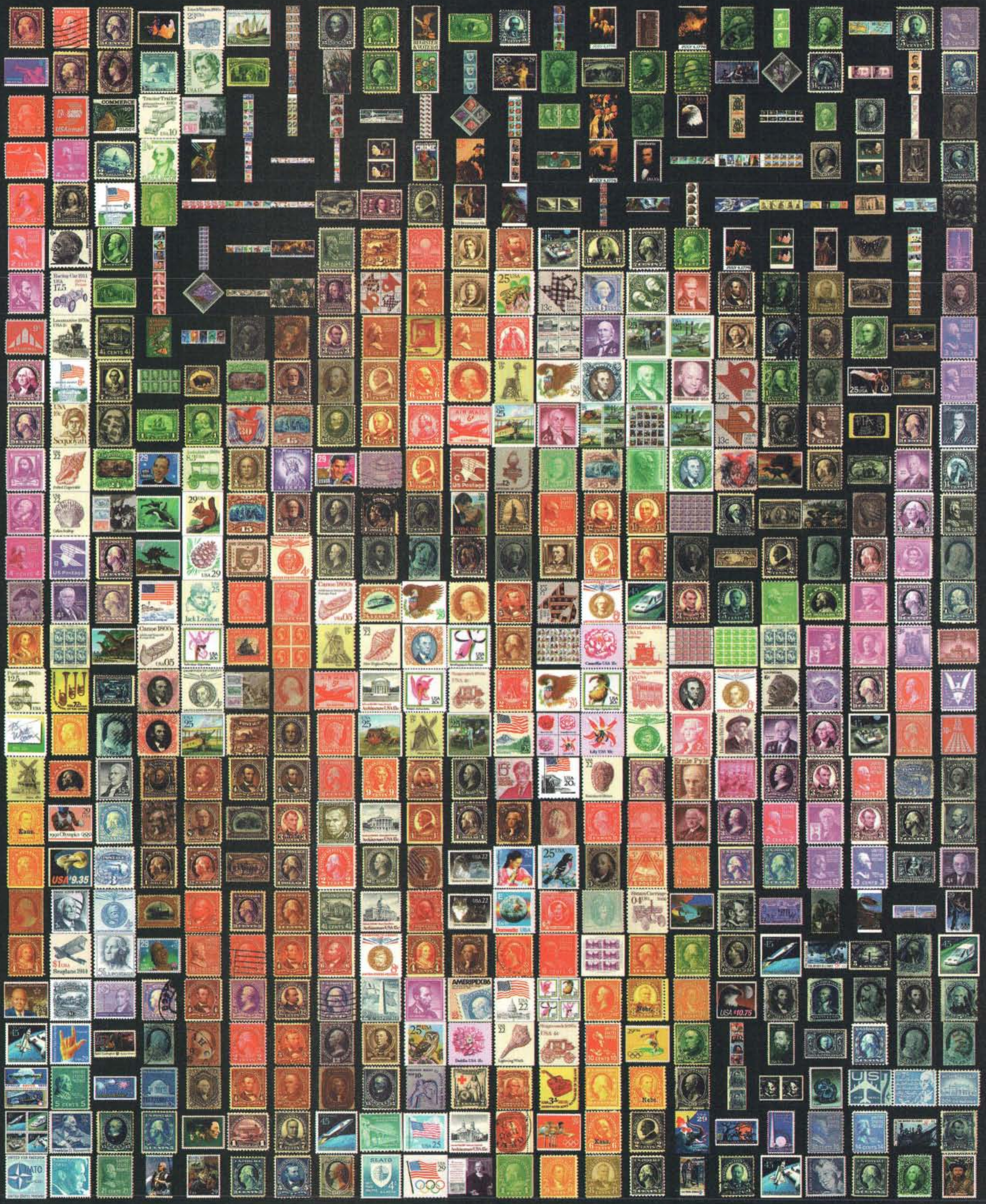
Rob Silvers of Runaway Technology made the image based on the US Postal Service's all-time best-selling commemorative stamp. The software that put it together was a product of his graduate work at the MIT Media Lab.

Optimal viewing distance is about six feet. You can see more in Silver's new book, *Photomosaics*, published by Henry Holt. Orcheck *www.photomosaic.com/*.

– Spencer Reiss

Original image used by permission of Mark Stutzman, Elvis Presley Enterprises and the US Postal Service.

***Spencer Reiss is a features editor at* Wired.**



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The Engineering Coup

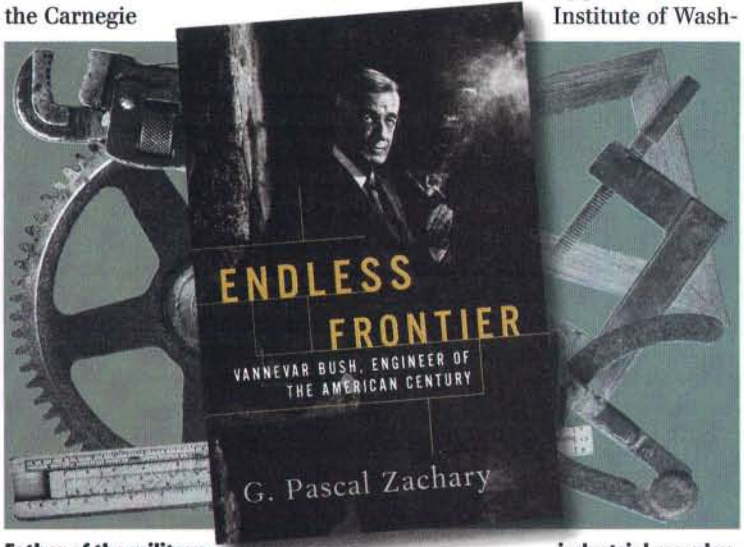
Vannevar Bush is best known for his 1945 essay "As We May Think," which described an imaginary, automated system to link together all of humanity's knowledge. It was a system, in short, that prefigured hypertext and the Web by almost 50 years.

But this visionary essay was really just a footnote to the life of a man who through force of will and obstinate determination helped create the modern, technocratic age. *Endless Frontier*, a new book by *Wall Street Journal* reporter G. Pascal Zachary, describes how Bush stamped his indelible imprint on our times.

First, Bush cast himself as a new kind of individual: an engineer. In the 1920s, this was a fuzzy category. Bush helped define the engineer as a hands-on sort of person - a new category, Zachary points out, that "conceived of education and expertise as the staging ground for risky journeys into the mysterious frontier of technical innovation."

But engineers might never have reached prominence in the national psyche if it weren't for a climactic event: World War II. This war of dumb machines drove home the primacy of technology.

When the US entered the war, Bush went from being president of the Carnegie Institute of Washington to FDR's right-hand man. It was Bush's skill at bureaucratic infighting that allowed him to succeed and establish a technocracy. Once World War II was over, engineers were firmly entrenched in the nation's power structure. They had helped the US win the war - just think of what they could do during peacetime!



Father of the military-industrial complex.

But, the ironic coda to this story is that after having helped create the military-industrial complex that defined the postwar era, Bush was deeply unhappy with what he had wrought. Here, Zachary becomes most eloquent, almost elegiacal. Bush had always been suspicious of big institutions, believing instead in the primacy of the creative individual. But, admitted Bush, as society and technology became more complex, humans became more like cogs. "Is courage needed to watch a radar screen or adjust a guided missile?" he asked.

Yet it was too late for anything but rhetorical questions. Vannevar Bush had already unleashed the Promethean force of technology that we continue to wrestle with. - *Steve G. Steinberg*

Endless Frontier: Vannevar Bush, Engineer of the American Century, by G. Pascal Zachary: US$32.50. The Free Press: (800) 223 2348, +1 (201) 967 5810.

DVD on Trial

You've heard about it, you've waited for it, now it's here: DVD. First the good news: it works. Very well.

In case you've missed the hype, DVD is either the next big step in optical data storage or the next big media white elephant. This ultra-infodense CD can hold about eight times as much text, audio, and/or video as today's optical disc.

Most controls will be familiar to movie fans. The Toshiba SD-3006 DVD player I tested has a solid freeze-frame, as well as fast forward and rewind that shoot you through the movie at up to eight times normal speed.

A gadget freak's dream. It can also hold as many as eight audio channels and 32 subtitle tracks.

Now the bad news: there isn't much product yet. Many studios are waiting to see how the market shakes out. The other drawback is that you can't record with it – yet. The long and short is: yes, DVD works, and no – unless you're a gadget or video freak – you shouldn't buy one. Wait a year. Prices will drop, and either more studios will join the jamboree or DVD will be headed for the Dead Media Museum. – *Richard Kadrey*

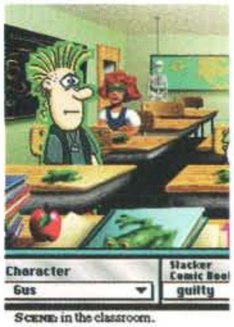
Toshiba SD-3006: US$699. Toshiba: (800) 631 3811, +1 (201) 628 8000.

Make a Scene

You're a director! A script writer! A cartoonist! You're a character-creating artist!

If a friend comes round and you want to make a movie or play together, Theatrix Interactive's *Hollywood High* is the ticket. Take it from an 11-year-old, it won't take you long to get the hang of it. First you select a setting, then you write a script, using characters you can animate. When your masterpiece is finished, you can view it in the theater or print out the script.

The graphics are well done. Unfortunately, the voices can sound a bit robotic, and words often sound muffled or distorted. You can fix this by going to the pronunciation dictionary, which will give you different ways to make the characters say their words.



SCENE: in the classroom.

Acting out.

You have a good choice of customizable characters. I'll tell you about a few: Jenny and Anna like sports, Gus is a cool zine maniac, and Lily is a typical teenager.

The range of actions could be better, especially if you could create some yourself. And you should also be able to make your own settings. But overall, this CD is hours of fun. – *Madeleine Jeanrenaud*

Hollywood High: US$29.95. Theatrix Interactive Inc.: +1 (415) 286 6000.

The Virtual Stagecoach

Let me make a confession. The crime I've committed buries me among the seedy ranks of sexist car salesmen, email spammers, suburban teenage panhandlers, dog owners who don't pick up, and (though I cringe to admit it) The Psychic Hotline. There is no excuse for what I did. But I was on deadline for a whip-cracking editor, and I had used all my deposit slips for bandages, and I needed that cold case of Bud to soothe my welts, and I had given my last two bucks to a crusty rain forest activist, and, and – I did it! I bounced a check.

But I've reformed! My friends and family never thought it would be possible, what with my propensity for making crucial deposits late and using my bank's monthly statements as kindling. But this behavior isn't a case of attention-deficit disorder, nor of reckless bourgeois rebellion against corporate America. I've tried to work their system – balancing checkbooks, saving ATM stubs, punching the correct code into the phone – but it didn't work for me. Until I jacked in to online banking a year ago.

Wells Fargo Bank – spin doctor of a new, bloodless Wild West where bandits cash your checks behind glass windows in climate-controlled concrete stagecoaches – has given me an alternative to people, paper, and temporary poverty due to inflated overdraft fees, thanks to the bank's outpost on the Internet *(www.wellsfargo.com/)*.

Banking in the new frontier.

Soon after a quick registration process, I was monitoring my checking account balance and transactions via my browser, downloading my account history, reordering checks, and using the ATM/branch locator for an upcoming road trip to the desert. My neglected savings account also popped up onscreen, boasting a balance of US$4.43, which inspired me to quickly transfer some bills – something I used to pledge I'd do with every paycheck, but rarely did.

Banking online with Wells Fargo is free (a surprise from an institution that slaps fees on most phone and ATM transactions). Using its online bill-paying service will set you back five bucks a month, but my buddy Hank the traveling minstrel swears by its convenience and reliability. If the bank loses my deposit (a recent nightmare), I'm much more likely to catch it online than in my (groan) archaic monthly statements.

Now, instead of taking a coffee break between spellchecks, I crank up my modem and scope out my accounts. I'm already an addict. Every so often I'll test drive their system and transfer funds back and forth between checking and savings to see if those cowboys can keep up. So far, they have. Next, I'll master online bill paying – anyone know the sound of one cybercheck bouncing? – *Tessa Rumsey*

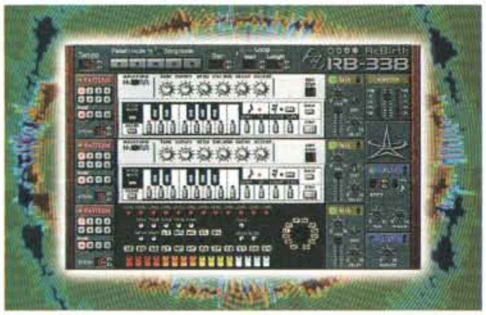
Wells Fargo: on the Web at *www.wellsfargo.com/*.

Bring That Beat Back

Just because I spent the 1980s banging on real instruments doesn't mean I didn't know what a Roland TR-808 drum machine was. The thing is legend. A pulsing light cycles across 16 buttons in a row; you turn a knob to pick a drum sound and push the buttons where you want the beats to fall. Its effect on electronic music was something akin to the Macintosh's on personal computing.

Discontinued in 1984, the once-cheap TR-808 has lately become more famous for its US$1,200 price tag. Luckily, the difference between an electronic box and a vintage drum set is that circuit designs can be emulated, and that's where the ReBirth RB-338 Techno Micro Composer steps in. The beat machine that engendered rap and techno returns on CD-ROM, with two TB-303 minisynthesizers thrown in for writing rubbery bass lines and squawking melodic chirps.

Playing with ReBirth is a very visual process. I did resort to the manual to see how to step-program the 303 synthesizers, but basically all the commands are self-explanatory. There is a distortion effect – click the light to apply it, then turn the dial until the drum sounds like a perfect trash can. Even song programming is as easy to make as buying candy from a vending machine: start with A1, then switch to B2 when you're sick of chewing. A Write to Hard Disk command ensures that if anything remotely profound comes from my tinkering, I can save a 16-bit sound file for further editing.



Rebirth of a techno legend.

ReBirth is a far better way to learn about music than focusing on one instrument. You work with odd and compelling sounds that make the music your own. I say screw piano lessons, to hell with "Stairway to Heaven" – hail the return of paradise for knob-twiddlers. – *Ian Christe*

ReBirth RB-338 Techno Micro Composer: US$199. Propellerhead Software: +46 (8) 641 25 70, on the Web at *www.propellerheads.se/*.

Poetry in Motion Platforms

From the exterior, the Iwerks Reactor touring motion theater doesn't look that impressive – just two shiny black trailers. Inside, however, lie some of the best rides you'll find outside a theme park.

Apart from the 18 pedestal seats (sort of Siamese barber chairs), the place looks like a shoebox multiplex. On entering, my first thought was that the illusion of movement couldn't possibly be effective because the video screen doesn't tilt with the chairs. But unlike most motion-platform rides, which shake the entire room, Reactor chairs move only two passengers and are therefore quite nimble. A tyrannosaur attacks and chases the audience in *Dino Island*, and it really feels as though you're traveling backward – a novel and scary effect.

Some of the computer-generated dinosaurs, an apatosaur in particular, are just too darn cute, and the trees look a little blocky, but that's like whining that Mr. Toad's Wild Ride is mostly painted plywood. *Dino Island* kicks Jurassic Park – The Ride's scaly butt.

The nimble Reactor far outpaces that *other* dinosaur ride.

Permanent stateside locations of Iwerks theaters include Six Flags parks in Arlington, Texas, and Jackson, New Jersey; Pier 39 on San Francisco's Fisherman's Wharf; Dollywood at Pigeon Forge, Tennessee; and the Empire State Building in New York. The theaters can also be found in such far-flung locales as Planet Fun Fun in Helsinki; Fancyworld at Yunelin Hsien, Taiwan; and Tatilya in Istanbul. While these sites may feature better projection and fancier themed exteriors than the touring theaters, the rides themselves are pretty much the same.

Hands down, the best thing about the Reactor is the attendants. When a well-scrubbed kid in a polo shirt throws a switch to jostle me walleyed, I feel much safer than when I trust the same task to a toothless, drunken carny running the Zipper.
– *Dan Howland*

Iwerks Reactor: approximately US$3 to $5 per ride. Iwerks Entertainment: +1 (818) 841 7766, fax +1 (818) 841 7847, on the Web at *www.iwerks.com/*.

Fast Company

Once the novelty wore off, I didn't really spend much time on the Web. I've got a few favorite pages, but following every intriguing link was just too slow. Who wants to wait for all those graphic index pages and broken-link error messages?

Then I got a cable modem. These things are *fast*. Faster than a 56-Kbps modem, faster than an ISDN link, faster than the overloaded T1 line at work. Cable modems are simply the fastest Internet access available short of a personal T1 line, at a price comparable to a dialup ISP plus a second phone line. The effective speed is even higher because the connection is always available. It's faster to check the weather or the movie listings online than to call the local information number, faster to scan CNN Interactive than to turn on Headline News.

MediaOne's service, available in the Boston metro area and expanding, is typical. The company installs a cable modem (rental included in the monthly fee), the necessary wiring, and the Ethernet card. The installation team configures your Win95, WinNT, or MacOS machine and makes sure it works before they leave - no user expertise required. The connection also works with virtually any OS supporting Dynamic Host Configuration Protocol, but you'll have to accept one of the supported OSes and reconfigure after the installers leave.

MediaOne's superquick cable modem.

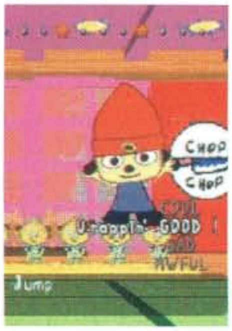
Wonderful though it is, a cable modem won't cure all your Internet woes. It won't fix slow response time. I tried *www.nasa.gov/* the day *Pathfinder* landed and still couldn't get through. More important, the service is even less secure than dialup. You share a single pseudo-Ethernet with as many as 500 households. Still, the blinding speed is well worth the extra security effort. Plug in a cable modem, kick back, and wait for the rest of the Internet to catch up. - *Katherine Derbyshire*

MediaOne Express: US$49.95 per month plus $99 installation, $39.95 per month with existing cable service. MediaOne: (888) 633 4266, on the Web at *www.mediaone.com/*.

Hot Diggity!

As much as I enjoy beating the crap out of karate mutants or driving silly cars at silly speeds, what I really long for are the games in which you didn't have to remember 17-button moves. Basically, games like *Parappa the Rapper*.

Released earlier this year in Japan – where 40 percent of its 600,000-plus buyers were women – *Parappa* is the most warped and stupidest Sony PlayStation game I've ever had the good fortune to play. In a psychedelic 3-D landscape, you control a floppy-thin, rapping 2-D dog who has to impress his would-be sweetheart by studying martial arts, passing a driving test, and baking a cake. While completing these tasks, you come into contact with various bizarre mentors such as Chop Chop Master Onion. They rap you instructions, and you have to copy what they say by pressing the buttons on your controller.



Rap attack.

When I heard about this game featuring "the world's first hip hop hero," I thought of characters shouting "Yo! Homeboy!" However, as soon as I played, I was enthralled. Alongside the amazing imagery and funky music, the sheer absurdity kept me smiling. In addition to being one of the first Sony titles to bridge the demographic gap, it's one of the funniest games the company has ever released.
– *Daniel Pemberton*

Parappa the Rapper for Sony PlayStation: US$30 to $50. Sony: (800) 345 7669, on the Web at *www.playstation.com/*.

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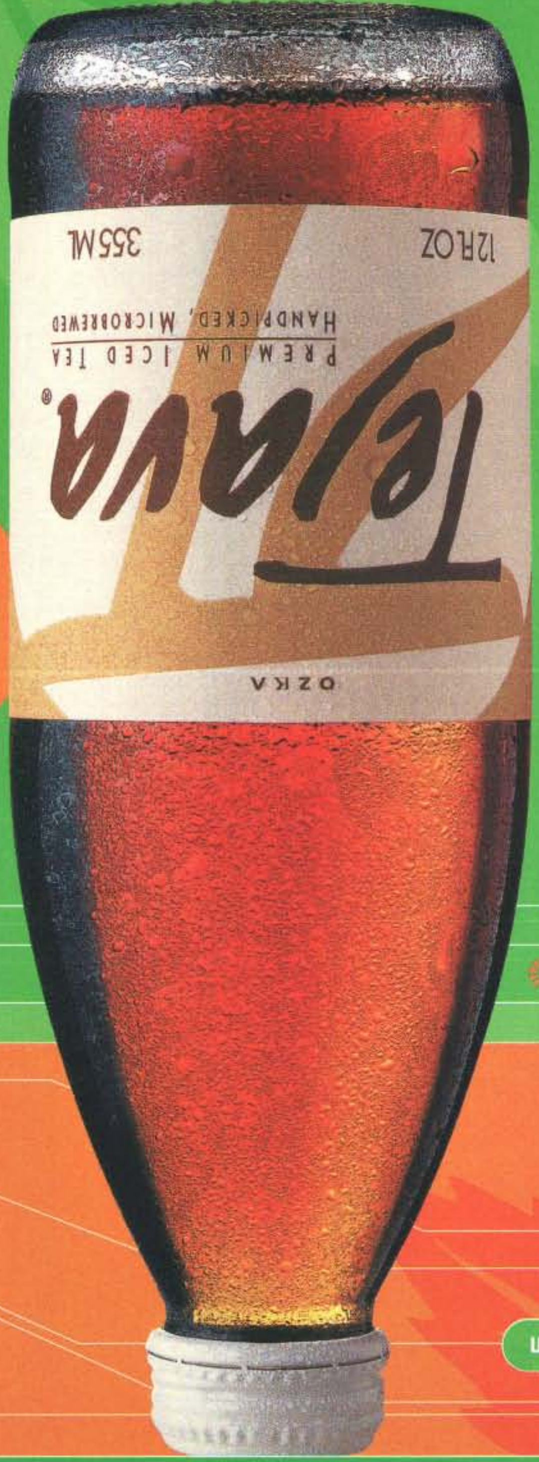

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Sci Eye **In 1955, Robert Schulz drew an illustration for the book *Operation Future* depicting a lunar excursion module that resembled the vehicle eventually sent to the Moon in 1969. *Infinite Worlds*, by Vincent di Fate, features Schulz's work and 600 other prescient visions of sci-fi artists.** *Release: October. Penguin USA:* www.penguin.com/.

COD DOA **When ATMs started spitting out stamps, it was only a matter of time before other machines began to cough up similar services. E-Stamp, hoping to usher in the greatest postal push since Pitney Bowes's meters, sends barcode-like postage over the Net – and prints right to your envelope.** *Release: late 1997. E-Stamp: +1 (415) 843 8000.*

Bungie Jump ***Myth* is for real. Crafted by Bungie, the designers behind the famed office time-waster *Marathon*, this new title raises the bar for real-time combat strategy games. Featuring customizable camera angles, realistic physics, and an intense focus on warfare tactics, *Myth* promises to be one of the keenest titles of the year.** *Release: late 1997. Bungie: +1 (312) 563 6200.*

Finger This **Built upon Bell Labs' research, the new fingerprint sensor on a computer chip, combined with networking software and a set of biometric-based cryptographic algorithms, makes your digital imprint the basis for every type of electronic identification.** *Release: October. Veridicom: +1 (415) 926 7765.*

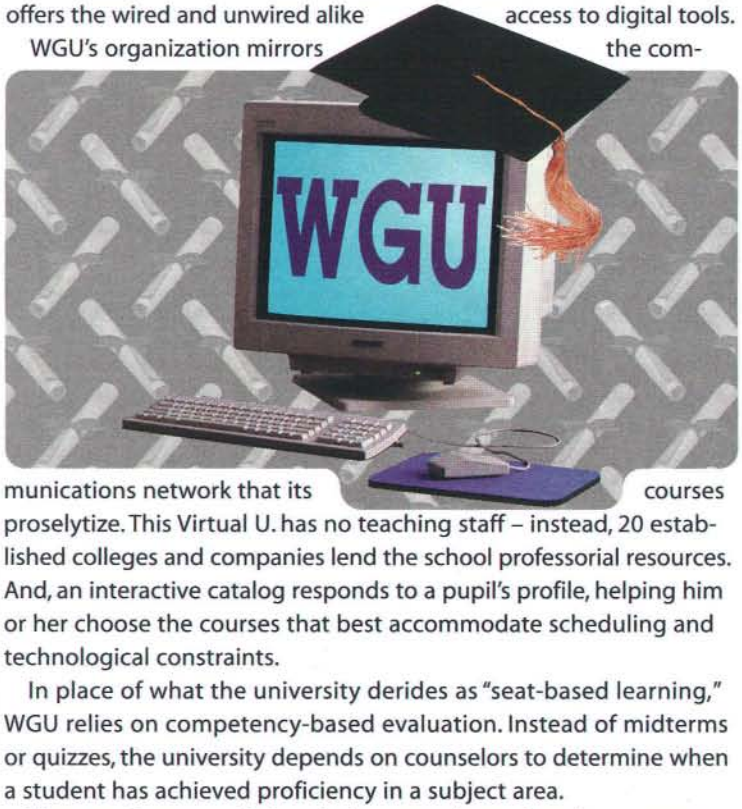
Public Secrets ***Technology and Privacy*, edited by EPIC director Marc Rotenberg and professor Philip Agre, calls for a reconceptualization of privacy policy. Chapters – authored by Agre plus the likes of Simon Davies and Robert Gellman – detail the challenge of keeping information personal in the bandwidth-friendly, e-commercial, digital-media world of tomorrow.** *Release: October. MIT Press: +1 (617) 253 5643*

Play-It-Buro **What happens when Boris Yeltsin sips his last White Russian? *Politika* – a new game from Tom Clancy's company Red Storm Entertainment – sucks players into this Kremlin power vacuum. Using IBM's InVerse technology, which allows Java chat to figure prominently in *Politika's* plot, the Net-based title turns online gaming into collaborative storytelling.** *Release: fall. Red Storm Entertainment:* www.redstorm.com/.

Distance Learning for the Masses

Higher learning just got more convenient. By exploiting the communications potential of the Net, Western Governors University will offer diplomas to people all over the world, beginning in January. While distance learning is hardly a new concept, WGU is unique in its ambition: it will be the first institution in the US to offer vocational certificates and associate arts degrees – eventually adding bachelor's and graduate degrees – without a physical campus.

Often, geographic barriers, scheduling conflicts, and overenrollment prevent students from taking the classes necessary for matriculation or career advancement. But WGU's plan accommodates an individual student's needs, even if the pupil doesn't own a home computer. An extensive network of affiliated public libraries and regional sites offers the wired and unwired alike access to digital tools.



WGU's organization mirrors the communications network that its courses proselytize. This Virtual U. has no teaching staff – instead, 20 established colleges and companies lend the school professorial resources. And, an interactive catalog responds to a pupil's profile, helping him or her choose the courses that best accommodate scheduling and technological constraints.

In place of what the university derides as "seat-based learning," WGU relies on competency-based evaluation. Instead of midterms or quizzes, the university depends on counselors to determine when a student has achieved proficiency in a subject area.

Western Governors University's approach won't replace conventional teaching anytime soon, but it's part of a trend to give remote students and working stiffs equal access to educational opportunities. – *Anne Speedie*

Release: January 1998. Western Governors University: +1 (303) 364 7137.

Steve Reich

Works: 1965-1995

Nonesuch

Minimalist music has had a profound and far-reaching impact on contemporary sound, and pioneer Steve Reich is perhaps the finest purveyor among his brethren. His peers – including everyone from Philip Glass and John Adams to Michael Nyman, Brian Eno, David Byrne, and David Bowie – owe an enormous debt to Reich. In celebration of Reich's 60th birthday, Nonesuch has released a massive 10-CD retrospective, including his first groundbreaking works, his most recent compositions, and four new recordings.

Reich's early work is characterized by a minimum of musical means: a strong, virtually mechanical pulse, repetition of short melodic patterns, tonal harmonic structures. These austere and straightforward elements help define his music, a gradually unfolding process with altered time frame and non-narrative character. Later work became more colorful, varied, and supple, but his identifiable stylistic gestures remain. Reich's portfolio speaks a distinctive and idiosyncratic language, with interlocking and percolating rhythms and a penchant for luxuriant timbres.

To those less familiar with Reich, the Nonesuch retrospective reveals the remarkable range of his work. From the simplicity of two performers using only their hands in "Clapping Music" – with its vivacious, flamenco-inspired syncopations – to the larger-than-life orchestral and choral "Desert Music"; from the monochromatic and maddeningly incessant "Four Organs" to the glories of "Music for 18 Musicians," with its harmonic richness and sumptuous instrumental colors; from the earthy, jazzy refrains of "New York Counterpoint" to the religious ecstasy of "Tehillim"; from the simple speech of "Come Out" to the stunning, virtuosic display of "Drumming" – this look back over Reich's music finds it utterly contemporary, relevant, and compelling.

– Dean Suzuki

Rapoon

Darker by Light

Soleilmoon

As cofounder of Zoviet France, Robin Storey drove ambient noise into new territories; as Rapoon, Storey continues a tradition of making abstract, investigative sounds. From harsh industrial beats to faint murmurs of cadence, percussion fills *Darker by Light*. The first track's synthesized arhythmic pulse is unsettling even while it tries to soothe. The rest of the release exudes similar impressions of displacements and distended time, a challenge fully met by disc's end. While too acerbic to fulfill most definitions of ambient music, Rapoon creates fields of intangible solace within its pulsating machinations.

– Alan E. Rapp

Amon Tobin

Bricolage

Ninja Tune

Here's what you get when a Brazilian-born, globe-trotting, jazz- and hip hop-loving street musician turns to making records. Amon Tobin's influences are dizzying: hot jazz, frenetic low-end stuttering, twisted samba strains, and all manner of underground dance rhythms. He appropriates the familiar sounds of upright bass, drum kit, and horns. He imagines the mutant bossa nova of "One Day in My Garden" and the lush and exotic drum-and-bass epic "Mission." *Bricolage* represents new music that can't be categorized or ignored, but if there's a link between Gilberto Gil and Goldie, it's right here. *– Scott Taves*

Keystone Trio

Newklear Music: The Songs of Sonny Rollins

Milestone

Pianist John Hicks, bassist George Mraz, and drummer Idris Muhammad have copped more than a few Sonny Rollins licks in their lifetimes. As one of few living jazz legends, saxophonist Rollins (aka Newk) has inspired generations of players. But this time out, the Keystone Trio is strictly aboveboard. Paying tribute to the jazzist-as-composer, it explores Newk's oft-underrated and overlooked forte. Rollins's song writing rivals that of Cole Porter: from calypso to ballad, his beautifully swinging oeuvre comes to life in the hands of a most synchronized, truly masterful rhythm section.

– James Rozzi

Väsen

Whirled

NorthSide

Like a mild-mannered Viking horde, Väsen tumbles out of its home turf in Sweden and scampers across the globe, touching India, the South Seas, Hungary, and France (not to mention Scandinavia) before making it home in time for dinner. More eclectic than your average bear, the quartet turns tunes inside out and upside down, driven by fiddle and *nyckelharpa* and grounded by inventive percussion. Its sound may be traditional, but its attitude is completely modern, mixing folk's honesty, prog-rock's virtuosity and insane asylum humor into a Cuisinart of acoustic bliss. Visualize whirled music. *– Chris Nickson*

Photek

Modus Operandi

Astralwerks

Photek is Rupert Parkes, a 25-year-old from Saint Albans in Hertfordshire, England, but his music evokes paranoia in contrast to his years and locale. Exploiting the terse space between the beats of drum and bass, Parkes fills it with shifting frequencies, brushed snares, and low-stringed riffs. *Modus Operandi* captures this potent array of sounds and showcases Parkes's uncanny sense of tension and timing. Songs such as "Minotaur" and "The Hidden Camera" take advantage of dramatic pauses and resonating undercurrents – closer to Kabuki theater than the latest dance music classification.

– Dan Sicko

Luke Vibert

Big Soup

Mo' Wax/ffrr

After critical acclaim for albums by his alter egos Wagon Christ and Plug, Englishman Luke Vibert steps out under his own name to lay claim to a wide range of sonic possibilities – big band mutations, traditional jazz, twisted drum and bass. Vibert's flair for the theatrical pops up in a track like "Voyage of the Unknown," which molds the '50s-era theme song into futuristic sci-fi, and "Reality Check," which uses samples of whimsical cartoon squeaks to form a pointillist melody. No flies in this one, *Big Soup* is a glorious trip of a disc that needs no outside assistance to make its point.

– Tamara Palmer

The Bevis Frond

Son of Walter

Flydaddy

"My lights are changing," sang Nick Saloman, the Bevis Frond's single member, in 1988. That was on *Triptych*, and Saloman meant it as a caveat. In light of his latest recording, however, it was more of a premonition: stateside release of this work signals a resurgent appreciation for the noodly psychedelia of which this Brit is the master. Some dismiss him as a far-out hippie revivalist, yet others claim he's the finest electric guitarist working anywhere. *Son of Walter* should make a fan of the unconverted – after a few listens, even skeptics will applaud Saloman's well-deserved leap from obscurity.

– Jennie Ruggles

Scanner

Delivery

Rawkus

Voyeurism is always ripe for exploitation. Scanner lifts private conversations from a cell phone scanner, incorporating them into moody sound paintings and shadowy dance music. Imagine a cuckolded sod, equally pathetic and psychotic, tearfully arguing with his ex on "Heidi," or sweet nothings traded 'tween a man and his mistress on "Affaire." Part club disc, part horror soundtrack, *Delivery* wanders all over the sonic map, televoices drifting through like ghosts, washes of sound rising and falling like breath. Scanner's provocative work escorts us to the brink of hearing more than we want to.

– Colin Berry

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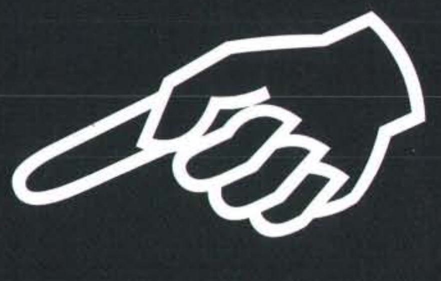

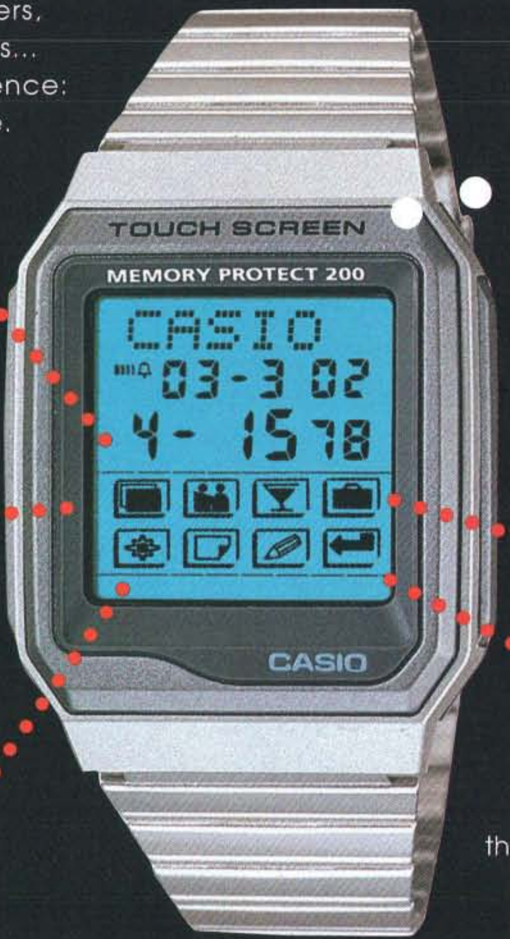

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Altered State

As US record labels rush to popularize electronic music as the new zeitgeist, the UK emerges with a generation weaned on – and jaded by – the pharmacology and rhythms that permeated its cultural scene for nearly 10 years.

As one of the first journalists on this beat, Matthew Collin steps forward with *Altered state*, a fascinating account of the movement's political, social, and historical implications.

Collin traces the roots of acid-house music with an eclectic ear and a sharp wit, jumping from the house music bubbling up from the gay clubs of New York to English contributions like New Order. He also charts the birth and journey of the rave-fave drug Ecstasy. Collin's interweaving of the two stories is masterful.

Techno-love is the drug.

Altered state mixes an astute blend of media reportage and oral histories into a tale as irresistible as the culture that inspired it. – *Tamara Palmer*

Altered state: The Story of Ecstasy Culture and Acid House, by Matthew Collin: US$16.99. Serpent's Tail: +1 (612) 690 0907.

On the Mark

Remember when the freshest antiestablishment statement was the subversion of corporate logotypes? Those twisted trademark variations were prominently displayed on T-shirts, handbills, and skateboards in all the worst neighborhoods. Nike, McDonald's, and Tide were parodied in campaigns for sex, marijuana, and raves. But to find inspiration young entrepreneurs had to either buy the product or scour the libraries. If only *Marks of Excellence* had existed then, those hours could have been spent actively pursuing sex, drugs, and rock and roll.

This book is an image fix for pop culture junkies, a visual reference for designers, and a crash course in semiotics for those who spent their college years doing other things but have ended up at the same dinner parties as those who studied structuralism, linguistics, and Saussure. *Marks* looks at the significance of logos, monograms, metaphors, products, packaging, penguins, pretzels, brands, buildings, and more logos.

Scandinavian designer and author Per Mollerup's analysis and anecdotes fill the book's text, while the captions tell specific trademark histories. Take the red and blue barber's pole, which I had previously considered a quaint relic of a kinder time. But traditionally barbers also performed surgery, including bloodletting. "To further the bloodletting, patients were given a pole to grip. When not in use, the pole hung outside the barber surgeon's shop with the bloodstained bandage that was twisted around the patient's arm." A little off the top, anyone?

Branding 101: labels that stick.

On the other hand, there is little comment on one of history's most potent motifs, which merits a single sentence: "The swastika is an ancient symbol whose meaning for people in the West was changed as a result of its appropriation by the Nazis."

The bulk of *Marks of Excellence* is devoted to the commercial logos that dominate the world and how they got there. As an art director, I found it humbling to realize how many classic identities were created not by designers, but rather by company founders. The look of *The Wall Street Journal* was devised by Charles Dow, Edward Jones, and Charles Bergstresser. Coco Chanel designed the elegant No. 5 package, and R. J. Reynolds takes the rap for Joe Camel.

A book that rigorously examines trademarks and their meaning is essential for the bookshelves of the visually inclined. It's also destined for the coffee tables of today's corporate wonks obsessed with branding. As a tasty book ready to be consumed, *Marks of Excellence* exemplifies the commodity value of visual identity. – *Rhonda Rubinstein*

Marks of Excellence: The Function and Variety of Trademarks, by Per Mollerup: US$75. Phaidon Press: (800) 722 6657, +1 (415) 777 8467.

Hand Job

What makes Psion Series 5 stand out from the competition?

OK, first the boring stuff. Psion has been doing this longer than anyone, its palmtops dominate the worldwide market, and it has the best designers of any portable PC company (it's the Apple of the palmtop world – Apple before it fucked everything up, that is). The new Series 5 machine has the largest, highest-definition screen on the market; a proper keyboard instead of one of these stupid little button things (the keyboard itself is bloody revolutionary, and the machine has a stylus, too); and a built-in digital dictaphone – a proper one, with buttons on the outside of the case; and a full range of accessories (modems, printers, et cetera).

But what's really cool is that the Series 5 runs on a StrongARM chip, developed jointly by ARM of Cambridge, England, and Digital Semiconductor.

Fast functionality at your fingertips.

Have you heard about this? It's what's inside Oracle's network computer. The chip is amazingly fast, and Psion has written a new operating system for it that comes ready with full Windows/Mac translation software. The chip will also be used in mobile phones and other intelligent consumer gadgets. In fact, because Psion also owns modem maker Dacom, the company is busy working out extremely cool new data transfer protocols that will have a serious impact on mobile communications. So, as well as being the best piece of kit on the market, the new Psion palmtop stands at the center of all this.

Told you it was good. As you might have guessed, I already use a Psion 3, which I think is fantastic. But this new one is unbelievable. – *James Flint*

Psion Series 5: US$599 for 4-Mbyte version, $699 for 8-Mbyte version. Psion: (800) 997 7466, +1 (508) 371 0310.

Petite Plume

For years I've been looking for a good way to keep a pen on my person. Shirt pockets fail when your shirt has no pockets. Pointy pens pierce pants pockets. Short pens make my hand cramp. For a few years, I had a penholder on my belt, along with beeper, Swiss Army knife, glasses case, pedometer, and Leatherman. I looked like Batnerd wearing a Batbelt.

Recently, I stumbled across Fisher Space Pens. Most advertising blandishments leave me cold, but Fisher Space Pens, with their high tech gas-pressure supply, I'm told, are used by astronauts and will write underwater and upside down. I tried recalling the number of times I've wanted to pen something while submerged, but I'm no Jacques Cousteau. I also tend to avoid being upside down, at least when I'm writing.

Aquatic pen pal.

I was lukewarm until I saw the design of two Fisher models. These solid brass pens have a cover that slips on to make a compact 3 3/4-inch package. When you put the lid on the back, they become full-size pens. The writing is smooth, and they always start without hesitation – unlike throwaways. There are other models, but the purist will not be deflected. – *Jef Raskin*

Model 400 Bullet Space Pen: US$17.95. Fisher Space Pen Company: on the Web at *www.xe.net/spacepen/*.

README *On the bookshelves of the digerati*

Founder of girl game developer Purple Moon, **BRENDA LAUREL** *enjoys forays into virtual reality and jazz venues on Bourbon Street.*
Scream. "For my kids, it was a hilarious adventure. For me – a frightening horror flick on par with *Carrie*. I just didn't get the subtle irony. Why the discrepancy? When I was young, I loved my parents' favorites. But my kids find *Star Wars* dated. With today's diversity in film genre and audience segmentation, my kids read film differently than me."
***Worldly Goods: A New History of the Renaissance,* by Lisa Jardine.** "Jardine reinterprets the history of the Renaissance as a revolution that wasn't motivated by the artistic or the scientific, but the economic. Artists and writers drove the development for mass production, for example. It's a notion that can be applied to today's media industry, where revolution is not simply the widespread publishing of ideas on the Net, but creating ideas and innovations that could work for us in monetary terms. Economics doesn't have to be a dirty word."

BILL GROSS, *an exhaustive entrepreneur who has built five companies from scratch, is founder of the Internet incubator idealab!*
***Net Gain: Expanding Markets Through Virtual Communities,* by John Hagel and Arthur G. Armstrong.** "According to Hagel and Armstrong, any company that doesn't open its services and merchandise to public discussion will be at a severe disadvantage. Something institutions would normally be afraid to do – lose spin control to the unsolicited comments and criticisms of outsiders – actually invites the consumer to become a tighter member of that community. It's a business model we've adopted."
Anything by Bill Gurley, author of the newsletter *Above the Crowd (www.upside.com/texis/columns/atc/)*. "Bill Gurley, analyst at Deutsche, Morgan Grenfell, offers a top-level abstraction of customer behavior and global trends in the tech industry. For example, he divides Internet commerce along two lines: Web sites that simply fill people's demands, and those that actually create new demands. It's the latter that will survive and thrive. That's information that we've applied to all of our Internet commerce sites."

Brenda Laurel

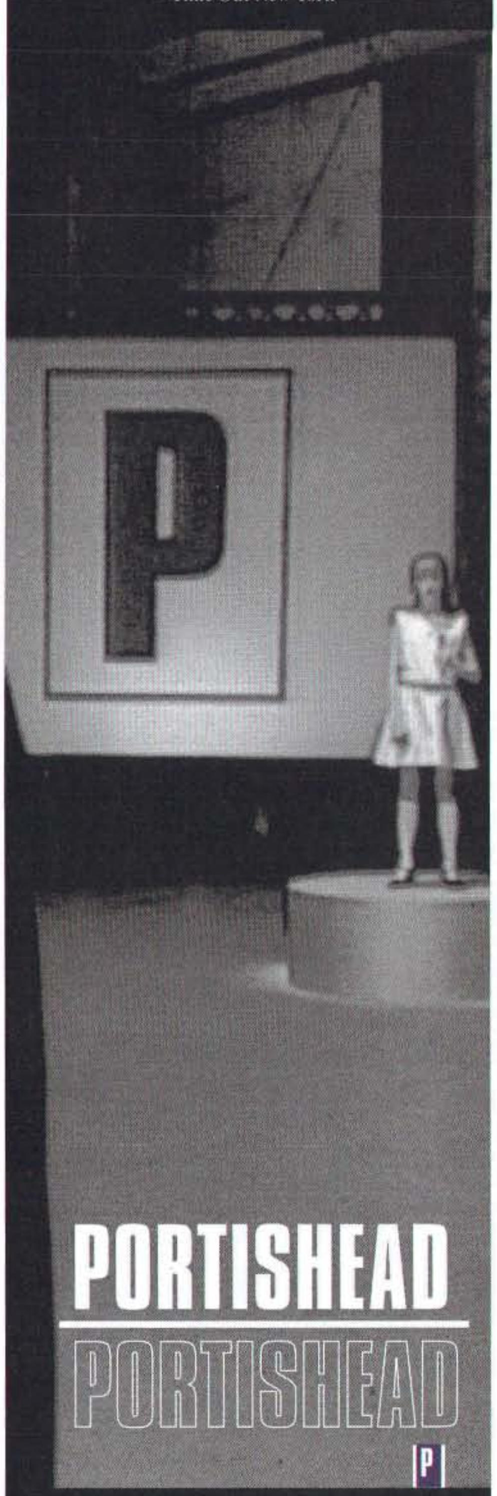
Bill Gross

Harmony Korine

HARMONY KORINE, *writer of both the screenplay* Kids *and his directorial début,* Gummo, *reads Groucho Marx and S. J. Perleman in his free time.*
***Eddie Cantor: A Bio-Bibliography,* by James Fisher.** "The work of Cantor, a turn-of-the-century vaudeville entertainer, is intrinsically futuristic and appropriate for the end of the millennium. Vaudeville wasn't about creating from scratch, but about making sense of what's been done before. In this regard, Cantor isn't much different from the "alternative" music of today, which is not alternative at all, but accumulated renditions and musings of the talent predating them.

"I also read **Walter Benjamin**. His philosophy regarding art in the age of mechanical production is as radical today as it was in the early part of this century. Like Cantor, Benjamin encapsulates a society of reiterations, where perhaps the great novel of our time is not original, but consists entirely of other peoples' quotations; where a film's narrative is not written, but ripped apart to its essence. Perhaps this is the predominant movement of the future."

"It's been three years since Portishead unleased Dummy, probably the seminal album of the '90s (aside from the Nevermind album, of course)"
- Time Out New York



PORTISHEAD
PORTISHEAD
P
IN STORES
9.30.97

Electronic Frontier Foundation
http://www.eff.org
privacy
liberty
democracy

WHERE WERE YOU WHEN THE ELECTRONIC WORLD WAS BEING BUILT?

The rules for electronic media are being written now. If industry leaders don't speak out, who will? Apathy is complicity.

WHERE WERE YOU WHEN:

- Clinton signed the Communications Decency Act (CDA) attempting to regulate content more restrictively online than in traditional media?
- U.S. encryption export law restricted availability of tools for Internet privacy and commerce?

EFF WAS THERE.

Since 1990, the Electronic Frontier Foundation has been protecting individual rights and promoting responsibility in the electronic world.

STAND UP. MAKE A DIFFERENCE. NOW IS THE TIME.

The consequences of inaction are ominous. Without effective intervention in the interest of civil liberties, the next generation could inherit a legacy marked, not by empowerment, but by constraint. We must take an active role in addressing the impact of technology on our work and lives.

SUPPORT EFF

http://www.eff.org/give

BE AN ANCESTOR YOU'D BE PROUD OF.

Electronic Frontier Foundation

Soylent But Deadly

Abe's Oddysee is the first installment in a quintology of cinematic games taking place in the aptly named Oddworld universe. In this dazzling game, you are a scrawny, hapless, slave-laboring creature named Abe. This downtrodden, three-toed, bug-eyed subordinate at the horrific RuptureFarms meatpacking plant blunders upon the ghastly secret ingredient in the company's proposed line of Meat Pop products: Abe and his fellow creature coworkers! The plan: escape from RuptureFarms with as many cohorts as you can manage. The problem: most of the other inhabitants of Oddworld will try to hamper your escape and/or hunt you down. The Odds, so to speak, are against you.

A communication system called GameSpeak assigns speech – "Hello," "Follow me," "Wait here" – to keyboard commands; for instance, when Abe tries to rescue a coworker, he uses one of these commands to order him to await further instructions. In this way, Abe leads his charges through traps, past guards, and away from other dangers. Once he ventures into the world outside the hellish RuptureFarms plant, the linguistic challenges increase, requiring Abe – and you, the player – to mimic in real time the gestures, tones, and bodily noises (don't even ask) of various creatures. Master this abstract conversational art form and you might just give Abe a connection; blow it and Abe's progress may prove difficult or even impossible. It's a little like trying to clear customs in some hostile, piss-pot Third World dictatorship with the old electronic game Simon as your only means of communication.

In Abe's world, the Odds are against you.

Developed by film industry expatriates, *Abe's Oddysee* integrates entertainment and ease-of-play: there are no CD-load wait times beyond the initial boot; gameplay tips are presented unobtrusively within objects such as factory control panels and monitor screens; the rich graphics are undisturbed by health meters, ammunition counters, or any other visual obstructions. *Abe's Oddysee* is less a test of thumb-twitching dexterity than a game about characters, plot, and enjoyment; every element is intended to involve the player emotionally as well as physically.

Forgiving enough for those who don't usually play games, *Abe's Oddysee* easily provides ample challenge, wit, and eye candy for the hardcore videogamer; whichever category you fall into, there's a very nice guy named Abe who needs your help. – *Chris Hudak*

Oddworld: Abe's Oddysee: US$59.95. GT Interactive Software: (800) 469 5961, +1 (716) 871 6646.

Fear Not

Technophobia usually suggests an irrational fear of technology, but in the CD-ROM of that name produced by digital artist Dooley Le Cappellaine, the word refers to new-media art that immerses viewers in various phobias. The object? To demonstrate how this format broadens our perceptions of "real" and "delusionary" fears – this work reminds us of the link between terror and beauty.

Click on a page of the book in the virtual gallery to open any of the 12 multimedia works. Bill Albertini's "Viewer" flashes on a television tuned to a dead channel. A mouse-click on its "ghost image" causes an abstract picture to materialize from outside the television, as if some form of video energy is lurking in the air awaiting human intervention. Best of all is Troy Innocent's "Techno Garden": a surreal emerald garden full of artificial life-forms cartoonishly mutates into simple geometric shapes, uncomfortably suggesting models of post-Chernobyl gene damage.

Beauty and the beast.

But all is not moribund. A hilarious satire on high tech advertising shows a series of authentic-sounding TV ads offering software to conquer death, raising the specter of a future in which fretful distinctions between artificial and natural states will no longer be cause for phobias. – *Norman Weinstein*

Technophobia: US$30. Dooley Le Cappellaine: +1 (212) 966 3046, on the Web at *www.thing.net/~dooley/*.

Street Cred Contributors

Colin Berry *(colin@wired.com)* edits *Wired*'s music section and is writing a pedestrian's guide to free art in San Francisco.

Ian Christe composes music for modern dance as himself, digital death metal as Dark Nœrd, and *Donkey Kong*-inspired drum and bass as DJ Bazillion.

Katherine Derbyshire *(kewms@kew.com)* writes about technology and digital culture from Stoneham, Massachusetts. She is chief technical editor at *Solid State Technology*.

James Flint *(flint@bigfoot.com)* was a section editor at *Wired* UK. His first novel, *Habitus*, will be out next year.

Dan Howland edits the zine *The Journal of Ride Theory* and contemplates spook houses and roller coasters a lot. Too much, really.

Chris Hudak *(gametheory@aol.com)* crashed the first *Wired* party and has been a contributor ever since. News of his exploits at industry parties has been scientifically proven to travel faster than light.

Madeleine Jeanrenaud stands poised on the threshold of adolescence clutching her electric guitar and wishing her fantastic sister weren't so far away.

Richard Kadrey *(kadrey@well.com)* is the author of the *Covert Culture Sourcebook* and two novels: *Metrophage* and *Kamikaze L'Amour*. He has no qualifications for anything he does.

Chris Nickson *(cnicks@sprynet.com)* was born in England and now lives in Seattle. Please have pity on him.

Tamara Palmer *(trance@netcom.com)* is a freelance writer and editor who finally moved back to San Francisco.

Daniel Pemberton *(danielp@dircon.co.uk)* would like to hear some good jokes, as he's run out. Please send him some new ones.

Alan E. Rapp *(rappa@sfgate.com)* is a book publicist and pad thai aficionado. He sincerely believes that you have his best interests at heart.

Jef Raskin *(jefraskin@aol.com)*, best known for creating the Macintosh project at Apple, now consults on and designs post-GUI interfaces. Whatever that means.

James Rozzi *(jrozzi@gcedunet.gac.peachnet.edu)* lives in Atlanta, where he's a musician, teacher, and writer with a local jazz column.

Rhonda Rubinstein is a magazine art director who began drawing corporate logos when she still had a purple banana-seat bicycle.

Jennie Ruggles *(jennie_ruggles@sbexpos.com)* is far taller than she is wide. She contributes to the *Time Out San Francisco Guide*.

Tessa Rumsey *(tessa43@aol.com)* would like a plane ticket to Egypt.

Dan Sicko *(urbfutur@mindspring.com)* is a contributing editor for *Urb* magazine, fledgling copywriter, webzine publisher, and Boston terrier wrangler.

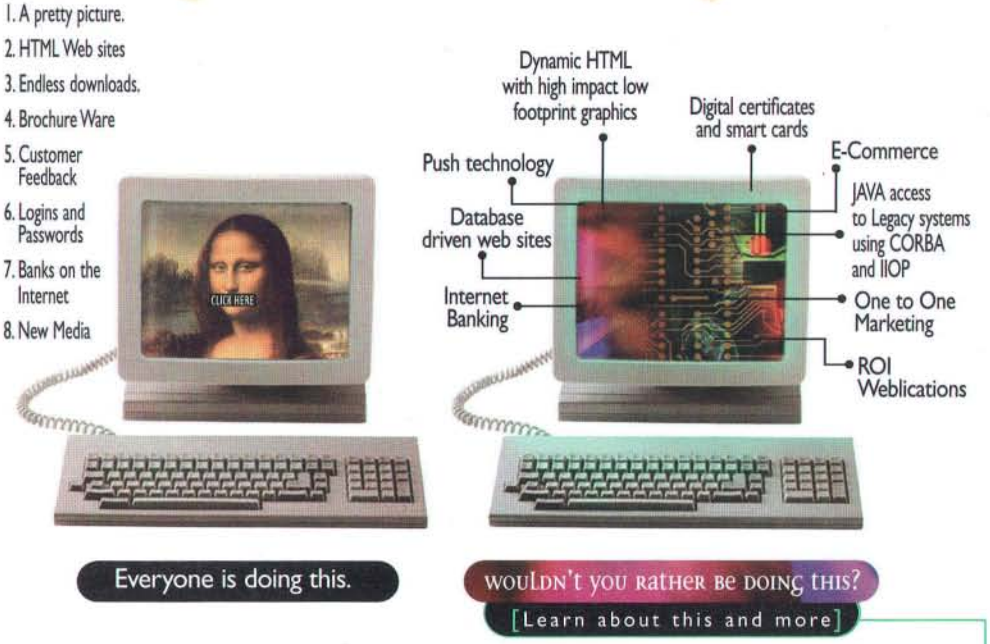
Steve G. Steinberg *(steve@wired.com)* is a technology consultant and a contributing editor at *Wired*.

Dean Suzuki, PhD *(dsuzuki@sfsu.edu)*, teaches music at San Francisco State University. He is also a programmer at KPFA in Berkeley, California.

Scott Taves *(staves@interaccess.com)* is the US manager of B+W music and The Blue Room record labels and author of *A Pocket Tour of Games on the Internet*.

Norman Weinstein reviews music for *Wired*, *Pulse!*, and *Monitor Radio* on NPR. He is writing a book about the physics and metaphysics of light in Frederic Church's paintings.

WHAT HAS YOUR WEBSITE DONE FOR YOU LATELY?



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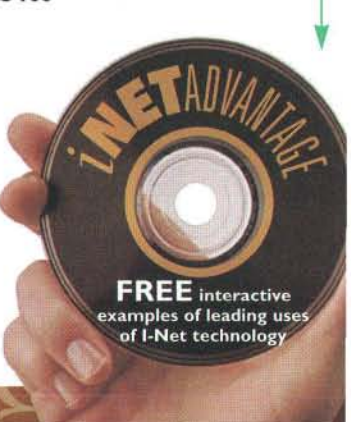
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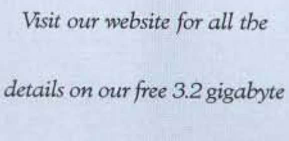
FREE interactive examples of leading uses of I-Net technology

IS THIS

JAZ OR THE

hustle?



DynaMO 640

FREE 5-PACK

Visit our website for all the details on our free 3.2 gigabyte 5-pack media offer.

Once you get past the cute name and trendy packaging, the only thing Jaz® users have left is a thinner wallet. Good thing there's DynaMO®640 removable storage from Fujitsu. DynaMO 640 is much more durable because it's magneto-optical (unlike Jaz). It lets you save your work on different media capacities ranging from 128MB to 640MB (unlike Jaz). You get free tech support (unlike Jaz). And it's less than half the cost of Jaz media,* with a 640MB cartridge going for only $25. (Bye-bye Jaz.) There's also our No Excuses℠ policy: Our promise that in the unlikely event your drive fails within warranty period, you'll get a replacement drive in two business days. For more details, without the hustle, call, or visit our website.

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(800) 898-1365 www.fcpa.com

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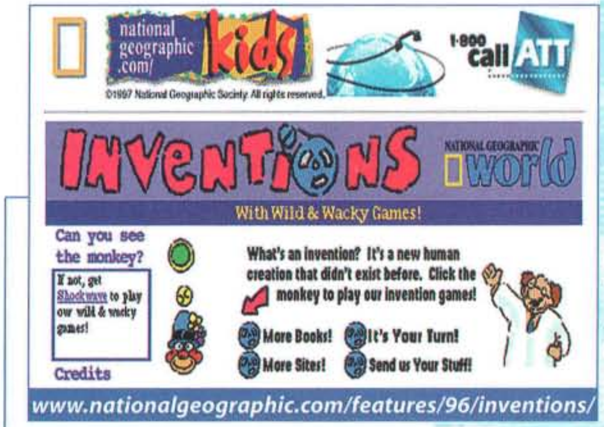
net surf

Edited by Kristine Kern

Intelligent Child's Play



If not, get Shockwave to play our wild & wacky games!

What's an invention? It's a new human creation that didn't exist before. Click the monkey to play our invention games!

www.nationalgeographic.com/features/96/inventions/

Everyone in charge of preteen children knows there are times when you need to compromise your already bottomed-out parenting standards. Like when you really, really need to lie on the couch and read the Sunday paper insert from Target. Or talk on the phone for 15 minutes without 15 interruptions. Instead of locking the pests in their rooms – God help me, I've done it – you can plop them in front of a screen.

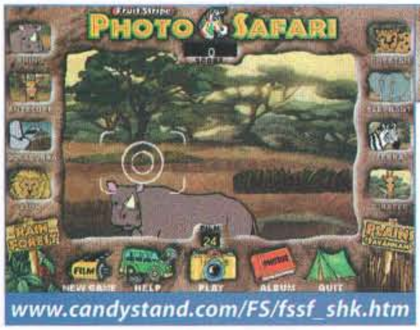
The Web has plenty of games for kids in the 7-to-12 range that don't have titles like *Death, Destruction, and More Death until Your Parents Make You Go to Bed*. Your charges will find they're having just as much fun with something tamer. The best games are also educational and free – though many are essentially advertisements for some kid-related product. All need Shockwave, downloadable at *www.macromedia.com/*.

National Geographic has produced an intelligent and beautifully designed guessing game about inventions, at *www.nationalgeographic.com/features/96/inventions/*. Kids make their way through five quizzes, learning that automatic doors were first used in ancient Egypt, for example, or that Post-it notes were invented accidentally. The beauty of the game is that there are no losers – players keep guessing until they get the right answer. When they've finished all five sections, they get to fill out a certificate declaring them Associate Inventor – a big hit with the fifth-grade set.

The inventions game links to National Geographic's site, with more pages about dinosaur eggs, wildlife refuges, and Inca treasure expeditions, all of which may keep the kids out of your hair longer.

Mad Libs, that goofy word game in which you fill in the blanks to complete a tale, has resurfaced on the medium it was meant for, the Web. Ever try playing by yourself? Didn't work – you knew which words belonged. But if your kid calls up Wacky Web Tales at *www.hmco.com/hmco/school/tales/*, she'll find that being alone is no handicap. Children can choose from a list of stories, some written by Houghton Mifflin (which sponsors the site), some by other children playing the game. After picking a tale, players fill out a form asking for different categories of words, such as past-tense verb, noun, and type of food. Then they view their story, enhanced with sentences like, "Out bleated an enormous wig covered with milk shakes." I remember going into hysterics over such gems.

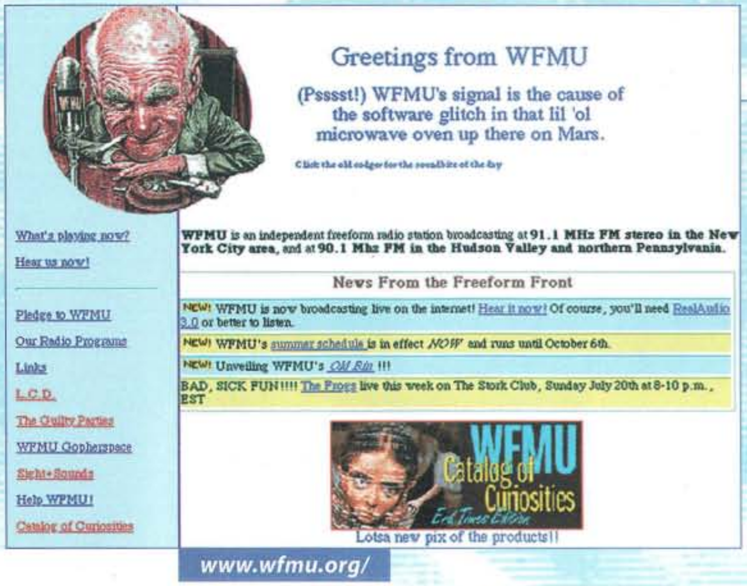
The Fruit Strip Photo Safari requires less brain power, but still offers some learnin'. The game, at *www.candystand.com/FS/fssf_shk.htm*, allows kids to choose between African plains or rain forest. A viewfinder appears in the foreground, and players snap photos of the lions, elephants, boa constrictors, and geckos that traverse the background. Once they've used up their film, budding photographers can peruse the photo album to see how well they centered their subjects. They can also read about where the animals live, listen to them growl, and find out why we should preserve their habitats. A caveat: The safari is part of the Life Savers candy Web site, so if your children follow links back to the homepage, they'll end up in a huge cyber monument to sugar.



www.candystand.com/FS/fssf_shk.htm

I guarantee these games will keep the rug rats quiet for at least half an hour. And if they spill the beans to the other parental unit that you encouraged them to play, here's a phrase to remember: "Education for the new millennium."

– *Mandy Erickson* (erickson@wenet.net)



Greetings from WFMU

(Psssst!) WFMU's signal is the cause of the software glitch in that lil 'ol microwave oven up there on Mars.

Click the old codger for the soundbite of the day

- What's playing now?
- Hear us now!
- Pledge to WFMU
- Our Radio Programs
- Links
- L.C.D.
- The Guilty Parties
- WFMU Gopherspace
- Sight+Sounds
- Help WFMU!
- Catalog of Curiosities

WFMU is an independent freeform radio station broadcasting at **91.1 MHz FM stereo in the New York City area,** and at **90.1 Mhz FM in the Hudson Valley and northern Pennsylvania.**

News From the Freeform Front

NEW! WFMU is now broadcasting live on the internet! Hear it now! Of course, you'll need RealAudio 3.0 or better to listen.

NEW! WFMU's summer schedule is in effect *NOW* and runs until October 6th.

NEW! Unveiling WFMU's *Old Bin* !!!

BAD, SICK FUN!!!! The Frogs live this week on The Stork Club, Sunday July 20th at 8-10 p.m., EST

Lotsa new pix of the products!!

www.wfmu.org/

Don't Touch That Browser!

Used to be that to hear a community radio station, you had to be parked beneath its transmitter, your FM dial carefully tuned to the hairline frequency. With recent Web innovations, however, such stations suddenly have the potential to reach global listening audiences. Free-form broadcaster WFMU recently joined a dozen or so tiny stations using streaming technology to blast their signals over the Web. A long-running independent from East Orange, New Jersey, the station operates *www.wfmu.org/*, which uses RealAudio plug-ins to webcast its esoteric programming: DJs segue between Coltrane, Shonen Knife, and Karlheinz Stockhausen.

WFMU joins nearly a dozen other stations that broadcast talk shows, athletic events, religious programming, and news over the Web. Some, like WREK in Atlanta, are affiliated with universities; others are low-wattage independents hitching their coattails to the Net. One site, *www.ontheair.com/*, is making itself the central switchhouse for these tiny squawkers, which blast using either RealAudio or StreamWorks formats. Such technology is altering listener demographics – requests come in via email as well as the phone. If you're searching for a diverse soundtrack while you're surfing, tune 'em in. Now if you could just win those Knitting Factory tickets …

Culture Crash Course

How many times have you heard the term *cyberculture* bandied about by some old stiff who thinks silver platform shoes are what it's all about? The Resource Center for Cyberculture Studies rightly claims that surfers will be hard-pressed to find such cyberdrool here. The site provides a must-read list of books and electronic journals that critique or celebrate cyberculture, interviews with theory and industry heavy hitters like Esther Dyson and *Wired*'s own Kevin Kelly, email addresses of academic types, events and conference listings, and links to related sites and community networks.

Perhaps the coolest feature is found through the various college syllabi, which sport reading lists and links of their own. These tools are meant to facilitate study, and may even inspire more savvy classes, like Georgetown's Technoculture from Frankenstein to Cyberpunk.

otal.umd.edu/~rccs/

Eye in the Sky

The Bay Area Digital Geo-Resource offers a peculiar view of the past. Using satellite images, Badger allows you pull up a somewhat dated overhead view of any SF Bay area zip code, street, or landmark. Designed by Lockheed Martin, NASA, and Smart Valley – a Silicon Valley business consortium – the site already seems retro, replete with predictions about the coming Web boom in 1995. But amid the three-year-old press releases, the future is ominously present in this convergence of geographic and civic data. It won't be long before enterprising companies find a mass-market use for a Badger-style eye in the sky. While some might scoff at the thought of an umbrella as a countersurveillance measure, imagine the Hair Club for Men running Badger photos through follicle-density analysis to target potential clients for its "Got Hair?" campaign.

badger.parl.com/

Optiganally Yours

Remember when Nixon ruled the free world and rock and roll was groovy? Well, today even the temporally challenged can jump on the retro bandwagon with the Virtual Optigan – an online version of optical organ that took its sounds from flexi-discs encoded with waveforms of actual instruments. This cheesy proto-sampler, coveted by collectors and rock stars alike, was made by Mattel in the early '70s. With a little help from Java, Randy Antler has created one of the most swingingly brilliant sites around. The Virtual Optigan lets you experience the real thing from the comfort of your own browser. You have all the talent you need to play, so with the click-n-drag of a mouse you'll be grooving like a pro before you can say "Moog-a-delic, baby!" Be warned: This trip is a bandwidth hog, so while you're waiting, cruise the Optiganally Yours homepage *(www.pilot.com/optigan/)* and learn the legend of Johnny Largo or the step-by-step process of making an Optigan disc. Next time the party train stops at your pad, surf over for some truly *mello* entertainment … laugh-in riot is more like it.

www.pilot.com/optigan/virtual.html

May the Best God Win

Hey, holy roller! Don't miss this chance to enter the Great God Contest, a match that pits your deity's omnipotent skills against other divine beings. If your god can meet three challenges – impregnating a virgin, raising a corpse, and either healing a sick person or feeding the multitudes – you have a winner! Onlookers can cheer for their god by offering prayers, songs, epithets, or verbal abuse. If you're not sure that your holy being has the power to succeed, check the handicappers sheet. Skeptics may take heart in these down-to-earth words from the Almighty One: "I am extremely embarrassed over those penis things. Although breasts weren't such a bad idea. I just should have built them sturdier. They just don't seem to hold up, do they?" Heavens!

www.islandnet.com/~luree/contest.html

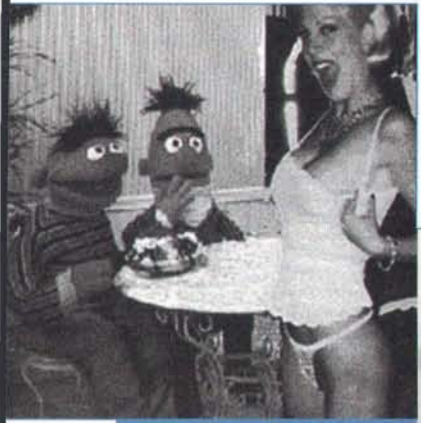
Drawing Conclusions

With the sound of a bell, a player enters Guess-a-Sketch, a Pictionary-meets-chat-room game by Digital Planet that is a no-brainer way to wind down. OK, maybe a half-brainer.

It's someone named Figgy's turn to draw. A black circle appears in the diagram box. Three dots start to form a face. "Snowman," someone guesses. "Doll," suggests another. Brown squiggles are added to the top of the head. "Chia Pet," I enter. No dice. "Good guess," someone writes. "Thanks," I answer.

The sound of a door closing makes the screen flash. "Mike has left the game," the webmaster writes. Time is dwindling. An arrow directs our attention to the brown mass. "Hair," "Curly," "Wig," answers come flying. The points diminish quickly. "Toupé," I venture. A trumpet sounds. Victory!

showcase.digiplanet.com/guessasketch.html



www.deepwell.com/skitzo/

Sesame Street Goes Skid Row

Some things make you want to toss your rubber ducky. The E Files, a shocking exposé site, reveals that *Sesame Street*'s Ernie is a far cry from the mild-mannered muppet we all know and love. Au contraire, the foam-nosed mop-top is apparently a chronic Bert-beater who favors a paper-clip pimpstick as his weapon of choice. Grainy mug shots are accompanied by captions detailing Ernie's crimes and misdemeanors. He's addicted to alcohol, loose women, and pornography. He's been hauled downtown for various offenses, ranging from slaughtering Bert's pigeons in a jealous rage to sodomizing Mr. Hooper. And dear, bruised Bert consistently refuses to press charges.

It's not entirely clear whether this site is gritty satire mocking ultraconservative claims that Ernie and Bert promote a homosexual lifestyle, or simply the product of demented geeks with too much time on their hands. Either way, it makes the Snuffleupagus conspiracy look like child's play.

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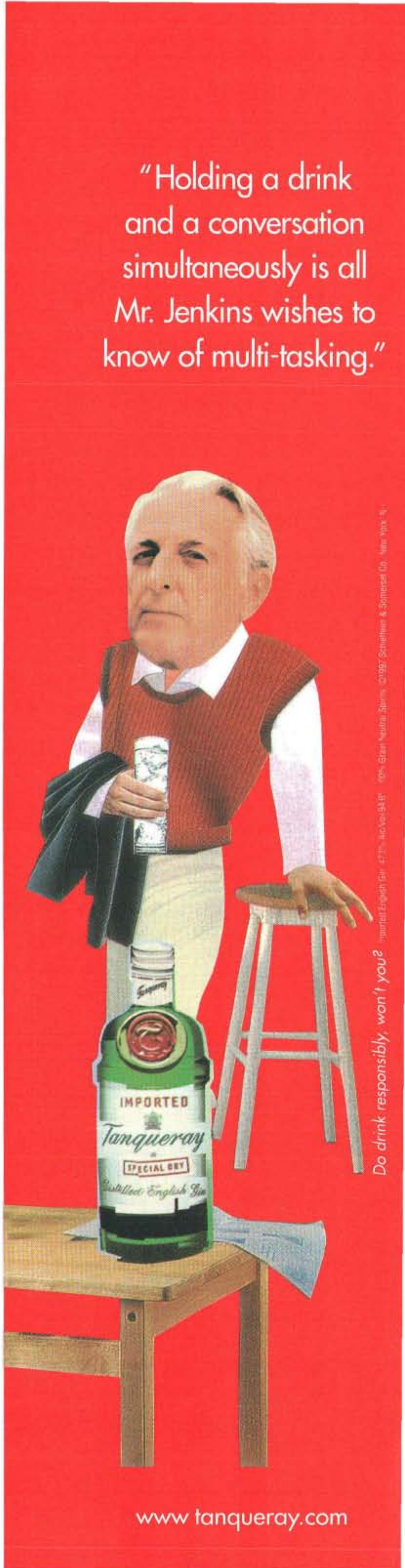
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"Now I look at all those changes," he explains, "and I say, 'This is about to have a bigger impact on electronic media than anything since we went from radio to TV. And even then, the TV industry took on so many of the structural characteristics that radio established before it: national networks, advertising interjected into the content, national programming.'

"So this is bigger. Much bigger."

A few days later, a very different group gathers amid the posh sprawl of the Inn at Spanish Bay in Pebble Beach, California. This is the Futures Summit of the National Association of Broadcasters, an élite retreat for a few dozen CEOs and other ranking barons of the airwaves. There are a couple of network types on hand. But the summit's real pillars, like those of the NAB as a whole, are the station holders – the lucky heirs of the great American spectrum handout, who each control anywhere from a fistful to a boatload of local stations.

From the looks of the summit's agenda, the NAB's future is not, well … broadcasting. Although the crowd comes straight from the platinum-plated heartland of Old Media, the sessions and seminars will consider not spectrum law, not prime-time audience fragmentation, not the confounding popularity of news magazine shows, but … the Net. Presenting over the next three days will be a veritable chorus line of Internet somebodies. Marimba's Kim Polese is on the agenda, as are the CEOs of soon-to-be Microsoft fiefdom Web TV, ecommerce might-have-been-giant Cybercash, and one of Glaser's direct competitors – Asaf Mohr of VDOnet. Ghost of Apple (then-)Present Gil Amelio and Ghost of Apple Past John Sculley also have airtime, as has Lord of the Skies Rupert Murdoch.

This isn't the first Net-centric NAB summit – that happened way back in early 1996, when the notion that the Web and TV were converging was still downright avant garde. That might seem to indicate that the NAB has a remarkably clear crystal ball, for an old boys' club. But broadcasters have long had strong Darwinian motives to keep an eye on television's Future – they've been positively stalked by it for decades. First that Future was cable. Then it mutated into another unbroadcast form: interactive television, one of the decade's better-publicized flameouts. Then, for a brief, cushy interlude, there was no Future. And then came the Internet.

Broadcast and the Net are friends, sharers of the same future. Right? Well … sort of.

Glaser is slated to present his take on this latest Future during the conference's second day. He strides into the inn the preceding afternoon, checks into his room for a manic series of phone calls and emails ("playing a bit of catch-up from the weekend," he explains, although it's still Sunday), then heads down to a cocktail-'n'-dinner reception in a posh Spanish Bay clubhouse. Here the food is abundant, the drinks unlimited, and the dress decidedly uncasual.

The buttoned-down setting might seem unlikely for a former United Farm Workers leafleteer and stalwart on the board of left-leaning, anti-establishmentarian *Mother Jones* magazine. (Glaser's company isn't called *Progressive* Networks for nothing.) Still, he's all charm and conviviality at this Establishment to-do – and there is no artifice in it. Friends say that Glaser has always been a natural at cohering with the people around him, and that tendency is every bit as *him* as the restless blurs of words that he emits. But more to the point, however big the transformation he seeks to catalyze – bigger-than-cable big, bigger-than-television big – Glaser does not believe that the ancien régime tithe-earners gathered here are necessarily doomed. To the contrary. "Physical community," he explains, "doesn't stop being important, even as virtual community becomes more accessible. Local issues matter. Local content matters. Local broadcasters aggregate local content and advertising, so I could certainly see them continuing to matter a lot, even if the infrastructure that delivers their content changes."

It's an upbeat take, very much in keeping with the summit's general tone. Broadcast and the Net are friends, complements, sharers of the same Future. Right?

Well … sort of. It is true that some synergistic and profitable broadcast/Net allegiances have already been forged. At last year's summit, for instance, Granite Broadcasting president Stuart Beck got to talking with Yahoo!'s Jerry Yang, and the result was a partnership that both sides still glow about: Yahoo! designates Web sites that Granite's nine affiliate stations can point to for further information on news stories. It is also true that the broadcasters' principal bedfellows – the major networks – are positively firehosing cash into the Net. An ardent broadcast booster could probably even find a positive spin to put on Microsoft's acquisition of WebTV ("It'll get them away from their computers and put them back in front of their TVs, right?")

But much of this can also be seen in a downright somber light. Sure, WebTV might pull some Netheads back to their living room couches. But should it become a mass-market hit, it will also give millions of TV viewers a lot more to gaze at than *Live at Five*. But broadcast's real nightmare isn't Web-ready televisions piping in HTML flip charts. It's not Java gamelets or stock quotes or static news headlines. The nightmare is full-screen, full-motion video. *Seinfeld*-on-demand. *Friends*-on-request. Not just 24-hour, but perpetual headline news, where it's top-of-the-hour whenever you hit that button. And all of it, maybe, brought to you via RealVideo.

Some forward-looking TV industry heavies are already taking the first steps down this path: using RealVideo and the Net to burrow through to audiences that can't be reached via coaxial cables or transmission towers – at the office, say, or on the far side of the world, or in a cable market where their network doesn't have a carrier. Murdoch's Fox News, a young CNN rival with cable distribution minimal enough to make even MSNBC feel good, can now be picked up by anyone with a 28.8 modem and a downloaded copy of Progressive's free RealPlayer. So can legislative superstation C-Span. So can Trinity Broadcasting Network, "the world's largest Christian network." And KWMJ of Tulsa, Oklahoma ("family-safe programming"). Bloomberg News is using it. So is a growing list of newly global stations and national networks, from Brazil, Chile, Taiwan, Spain, France, Hong Kong, and others. It's not *Friends*-on-request – yet (though it could be, if an NBC affiliate somewhere decides to join the list).

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This coin from the Isle of Man celebrates inventor Charles Babbage, the "grandfather" of the digital computer.

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But Glaser is happy to provide a pointed subtext: "Anyone who underestimates the depth of the transformation already under way will be out of business – or, at the very least, underserving the assets they're associated with."

Diehard skeptics can take heart from those teensy, grainy, jerky pictures – just a few inches square on most monitors. But recall RealAudio's improvement trajectory, then extrapolate – and factor in geometric improvements in bandwidth, as deep-pocketed RBOCs, cable systems, even electric utilities lunge for slices of the broadband pie. How the bits arrive – cable, fiber, satellite, xDSL phone lines – doesn't affect the need for compression technologies like RealVideo. Indeed, no matter how huge the pipes get, there is never such a thing as too much bandwidth. So its the technology that becomes the compression standard, that could find itself with a bombproof niche in the Internet's substrate.

Sure, the pictures are terrible. But recall RealAudio's trajectory, then extrapolate.

But to broadcasters, better and better Internet video looks like the ITV nightmare all over again. Only this time, matters will be far worse, because there is no reason the boundless Net will confine itself to an ITV-style menu of movies and canned programming. There will be live feeds (as there already are), be they 3-hour sporting events or 24-hour simulcasts from the other side of the globe. Reruns of popular shows will be available continuously – not just when it suits some broadcaster's whim. Even first-run shows will be accessible on demand – perhaps pay-per-view, perhaps ad-supported, but either way, no more bounded by broadcast schedules than rented movies are by theater showtimes. The NAB's worried transmitter holders have already been undermined plenty by hundred-channel cable snaking beneath our feet. How much more diminished will they be when 3,000-channel pipes – hell, an essentially unlimited number of "channels" – start sliding into our living rooms and dens? Pipes bearing signals from countless little network affiliates pumping from hundreds of little three-transmitter towns (hmmm, they all seem interchangeable, don't they?) and however many millions of garages and home studios?

None of this necessarily means the Death of Television. Indeed, Glaser believes that many of today's TV industry heavies – at least those with strong original content or coherent, well-branded themes – could ultimately thrive. "I'd rather be ESPN than the USA Network," he explains. "Networks like ESPN have deep identities – it ties together in a way that makes sense in a consumer's mind. But something like the USA Network or maybe TNT is a generalized entertainment franchise. Shelf space alone can be enough to build an audience when shelf space is tight. But shelf space per se becomes much less interesting when the shelf expands." And when choices are abundant, people tend to be drawn less by shallow, one-size-fits-all offerings. They want deep content that speaks to them directly.

So who benefits? Glaser isn't shy about predicting: "Aggregators who are *all over* sports, or *all over* news, or *all over* music, or kids stuff, or French impressionism, or cooking, or something that may not even have an economic model in the 36-channel world, but which has a deep and committed community – that's who will do great." At the same time, the "high-tonnage aggregators," the major national networks, may well hang onto important positions, simply because of their skills at funding original content. But lesser networks and content-poor local affiliates will be squeezed. When the dust finally settles, Glaser says, "there will still be broadcast television. There will be cable television, and there will be satellite. But the underlying consumer mechanism for delivering choice will be IP-based. There's no question about it. There is no competitor."

Four years ago, longtime Washington, DC, politico David Halperin was Glaser's charter partner in the project that eventually became Progressive Networks. They meant *progressive* in the vintage sense of left-leaning political activism. "It's fair to say that our original objective was social revolution," Halperin says – smuggling Fox News into CNN neighborhoods. But then, everything mutates on the Internet.

Glaser traces his interests in technology, mass media, and social revolution back to a modest neighborhood in Yonkers, New York, just two blocks north of the Bronx. His mother, a psychiatric social worker, worked with inner-city children. "For every kid that she was able to get through to, she'd see 50 she couldn't reach," Glaser recalls, "and meanwhile there'd be three or four thousand that she didn't know about." She and his father, who owned a local printing company, had no problem with extracurricular activities like leafleting for the UFW and organizing protests like 1982's massive No Nukes rally in Central Park.

Glaser was bused down to Fieldston, a private K-12 day school and arty bastion of Upper West Side New York liberalism, complete with an Ethical Culture curriculum. ("Unitarianism with even less God," says Glaser.) As a protogeek from Yonkers, he got some early training at Fieldston in what he calls "shifting gears between very different milieus of people" – his hip-effete classmates and neighborhood friends at the local bowling alley ("where they'd probably beat the shit out of you if you even used a word like *milieu*," he says). Glaser likes to compare himself to Woody Allen's chameleonlike antihero Leonard Zelig – an analogy old friends echo verbatim. Fieldston also gave him his first taste of the power of mass media: a "radio station" he and some friends set up that ran over the school's intercom. And it was at Fieldston that he first found happiness as a hacker, starting in fourth grade when he was sent off to play on the upper school's old DEC PDP-8 minicomputer – not exactly a fashionable activity back then. "I had a level of obliviousness that was helpful," he says. "I was so focused on what I was doing."

That focus propelled Glaser to Yale, where he served a long stint as editorial-page editor of the *Yale Daily News*, maintained a column called "What's Left," and ran a rather pissed-off organization called the Campaign Against Militarism & the Draft – all while putting in serious hours among the reclusive inhabitants of the CRT-lit computer labs. Cured of big-name technology by a summer job at IBM, he and three friends started a videogame company, self-consciously

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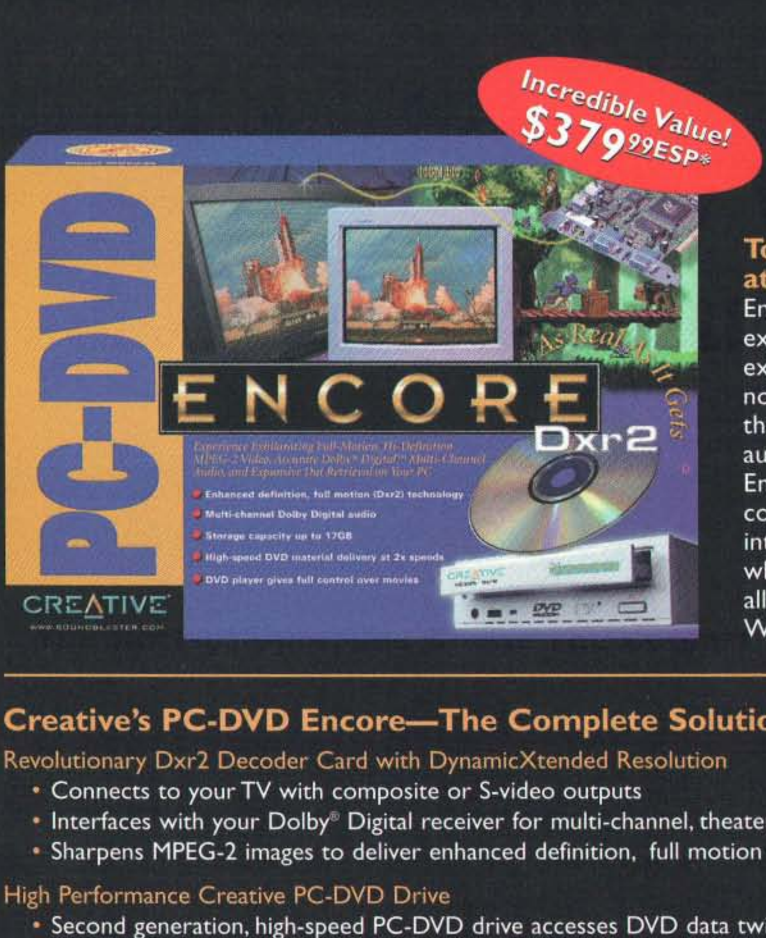

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named Ivy Research. They went on to release two racin' snake PC games – *Slynx* and *Viper* – that were distributed nationally through Computerland. But by graduation everyone was ready to move on, Glaser holding his own personal monument to overachievement: three degrees (a bachelor's in computer science, and a bachelor's and master's in economics) in four years. He was 21.

Glaser left Microsoft "a little bit angry," one longtime colleague recalls.

For a while he thought seriously about working as a UFW organizer, at $10 a week. But geekdom won out, specifically a chance to move to Seattle and work for a guy who'd left Harvard eight years earlier with no degrees at all. Microsoft in 1983 was still a fine haven for a subversive techie – a feisty pip-squeak with fewer than 300 employees going up against white-shirted IBM.

In Redmond, Glaser showed an early appreciation for the levers of power. He chose marketing and management over programming, he says, "because I didn't want to create a product that would get screwed up because the messaging was wrong or because the customers weren't listened to." He managed Word, the King Kong of word-processing, then moved into the company's networking group. Mike Slade, now CEO of Starwave and another early Microsoft lieutenant, remembers Glaser as someone who "just stayed there all night. He would never go home. Even when the rest of us knocked off at 9 or 10 o'clock. He was always there." He also had a computer at home, Slade says, "which in those days was practically like having your own mainframe. I mean, a home computer. It was like, 'What a geek!'"

Glaser did well enough to be named Microsoft's vice president of multimedia systems – in effect, a direct report to Gates himself. He did well enough financially to be able to buy a small piece of the Seattle Mariners. But 10 years into his Redmond sprint – and having just turned 30 – he got off the treadmill. Glaser says his departure stemmed from a very personal need to "up periscope." As he explains it, "My job satisfaction had gone from 90 percent to 70 percent," adding that "I'd kind of gotten spoiled early on, when Microsoft was the David to the IBM Goliath." Some Microsoft alums say a power struggle with Gates confidante and corporate macro-heavyweight Nathan Myhrold played a part. (Glaser left Microsoft "a little bit angry," one longtime colleague recalls.) But Slade puts a forward spin on Glaser's departure. "If you work at Microsoft," he says, "you want Bill to approve of you because he's so capable, because he's so difficult to please, and because he's so smart. And making it outside of Microsoft, doing something successful on your own, is the ultimate way to do that."

Officially on leave from Microsoft, Glaser upped periscope in the spring of 1993, then spent a couple of months drifting through Germany, Greece, and Egypt, thinking about what to do next. A summer course on

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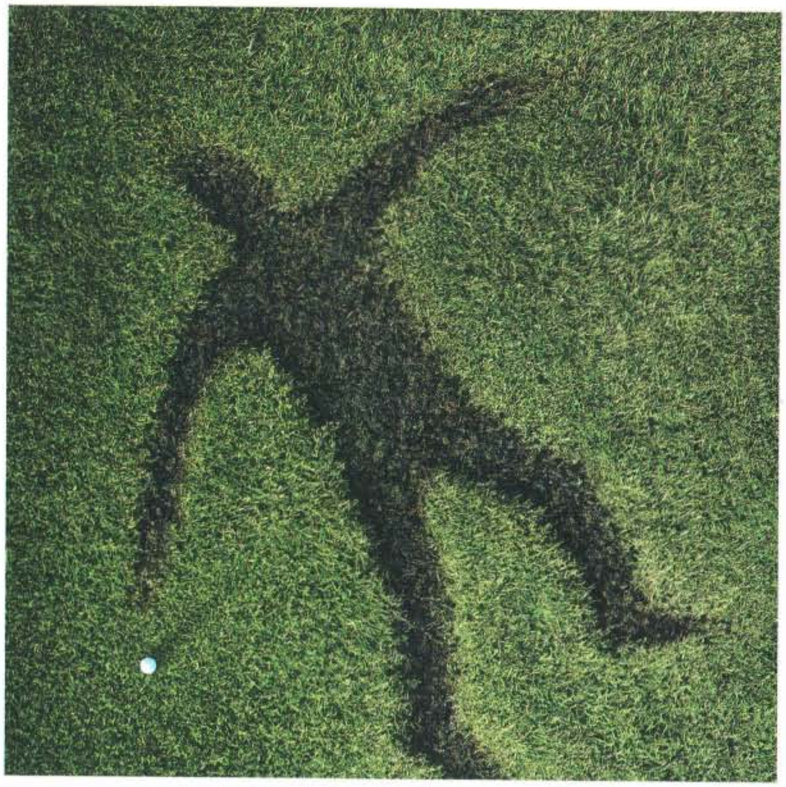

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the history of consumer culture at the University of Washington cured him of academe. He considered political activism and joined five nonprofit boards, including the Electronic Frontier Foundation and the Foundation for National Progress, which publishes *Mother Jones*. But Microsoft had spoiled him. "I was used to the kind of leverage you get when you enlist the power and incentive structure of the private sector," he says. "That made the incrementalism of the not-for-profit world kind of frustrating."

Glaser was left pondering a thread in his life that ran back to high school, what he calls "the nexus of media, computing, and communication" – an area that in 1993 was suddenly red hot. Glaser was particularly intrigued by the idea of harnessing new-media technology – even relatively old but underdeveloped media, like cable television – to generate and distribute "progressive" content. "People who pursue progressive agendas in the social or political sphere are often downright Luddite when it comes to technology," he says. So, instead of choosing between technology, media, and social causes, he would work in all of them.

The result was the seed of a company grandly dubbed Progressive Networks. In October 1993, Glaser was joined full time by Halperin, another Yale politico, but one who had followed the path his geekier friend forewent: not-for-profit work, law school, a staff job on Capitol Hill. Glaser's Microsoft winnings funded the effort. Pooling their connections, the pair met with media industry figures in New York, Los Angeles, San Francisco, Seattle, and Washington. Their agenda was constantly evolving – or, more bluntly, continually vague. One possibility they considered was building a "progressive" cable channel, or, perhaps just some cable programming. But what Glaser calls TV's "distribution hammerlock" was just too daunting. Meanwhile, the economics of another much-heralded new medium – CD-ROM – were proving downright dismal. Throughout it all, Glaser kept up his nonprofit work, did some consulting jobs for Microsoft, and watched his Mariners play ball.

Progressive's early agenda was constantly evolving – or, more bluntly, continually vague.

That same summer, one of Glaser's EFF connections steered him to some interesting new software, a noncommercial Internet browser called Mosaic. Glaser downloaded a copy, launched onto the World Wide Web, and had a not uncommon reaction: "a total revelation," he says.

The 1993 Web was not much to look at, much less listen to, or "watch." A few technically savvy cliques were already using the Net to distribute audio. (Remember Internet Radio's "Geek of the Week"?) But the download times were horrendous – a five-minute clip could require half an hour of thumb twiddling up front. The problem reminded Glaser of a demo he'd seen years before in Redmond: low-bit-rate audio distrib-

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uted over an internal network. And that produced an idea: through compression technology, it might become possible to "stream" an acceptable grade of audio content over the Internet – click on a selection and have it play more or less instantly, in real time. Radio, in other words, only with the listener in control. The Internet could then be used to distribute … who knew? Books on tape? Delta blues? *Social revolution*?

Glaser was sufficiently intrigued to dip back into his Microsoft stash and put three contractors to work on the problem of transferring sound across the Internet. His initial hope was that there could be "some real connective tissue" between the audio initiative and his and Halperin's would-be media project, which continued to not take off. The early demos were not flashy: Captain Picard from *Star Trek: The Next Generation* intoning, "Tea. Earl Grey. Hot." A baseball broadcast. The theme song from a cartoon called *Animaniacs*. But they pointed clearly to possibilities far larger than a politically correct cable show. And, as Halperin recalls, "Even the public-interest types seemed much more excited by audio running over the Net than by our grander social and political vision."

Video on the Net started at best as a fight for mindshare – to the extent anyone cared.

Building software instead of pursuing a partly formed media agenda had the added benefit, Halperin notes, of making Glaser "look less like he was Don Quixote and crazy." But Glaser himself was also convinced that the Web "was a once-in-a-generation thing" – much like the PC a decade before. And that gave even more appeal to the idea of a foot-to-the-floor, wildly-for-profit software company. "It used to seem like, how could you do software again and have the same kind of impact that you'd had at Microsoft," Glaser explains. "But once it was clear that the Net was about to change all the rules, suddenly you could have a broad impact outside the context of a big company." Not to mention, a little vindication.

Halperin went back to DC, while Glaser – still funding everything himself – staffed up his contractor force. By early 1995 he had nearly two dozen people on board and was ready for outside financing. Video was not even mentioned, at least not publicly. "There was an overwhelming impedance mismatch," Glaser says, "between the existing consumer-infrastructure 486-based PCs and 14.4 modems and the requirements of video. " His most advanced demo featured an audiocast of a baseball game, synchronized to an animated diamond showing the positions of runners and the score. The primary targets of Glaser's fundraising were private individuals with a deep understanding of technology, rather than funds or institutions; the round was ultimately led by Glaser's EFF boardmate, Lotus founder Mitch Kapor.

Video remained unmentioned when Progressive launched its first product suite at the NAB's massive annual conference (not to be confused with its élite summit) in Las Vegas in April 1995. RealAudio1.0 gave away fidelity to squeeze through a 14.4 modem in real time. Music – charitably called "AM quality" in the promo material – was a torment. But more significant than sonic fidelity was the fact that RealAudio worked – it delivered voice on demand: the Net spoke. And for anyone with longer vision, it pointed the way to richer streaming media – music, multimedia, and eventually video.

Glaser's strategy with RealAudio was no secret: push the technology, bring top content partners aboard, and turbocharge the user base – from 1 million at the end of 1995 to 10 million by October 1996 and more than 20 million today. Competition was quick to follow.

Xing Technology was second to market with StreamWorks, released six months after RealAudio. DSP Group followed with TrueSpeech, then Macromedia with Shockwave audio. All were close to RealAudio technologically, in some respects even superior. But by being first, signing up more compelling content, and distributing faster and farther (including with every copy of Internet Explorer ever shipped), Progressive held onto an overwhelming market share – now more than 85 percent, by credible internal estimates. And as Microsoft's own history shows, iron market grip can trump even a serious technological edge. Remember the Mac?

The move to video was more complex, in part because the shimmering lure of TV make the stakes intrinsically higher. Pioneered by Xing in late 1995, the Internet video market was soon contested by a pack of hungry start-ups – VDOnet, Vivo, VXtreme. But most of the software simply did not provide satisfying experiences over consumer-class modems – with the dubious possible exception of the inveterately early-adopter "adult" media crowd. Internet video was a market, Glaser says, "that was continuing to not take off." It was at best a fight for mindshare – to the extent that anyone cared.

Not that it would stay that way forever. With the rapid spread of Pentium-based computers and 28.8 modems – not to mention far faster corporate connections – the impedance mismatch that Glaser had once identified was starting to close. In December 1995, while attempting to vacation in Hawaii, Glaser got some email from a two-person San Francisco company, FreeVu, which had an Internet videoconferencing tool under development. Glaser took a look, was impressed, and persuaded FreeVu's principals to sign on as Progressive employees. RealVideo's development effort had begun.

Technology was only part of the problem. "You had to convince people that what you had was really better than what your competitors had," Glaser says. "But you also had to cross the threshold that got people to care about what you were doing at all. When a company like ours tells people that now is the time to care about video, and it turns out that now is not the time to care about video, we've hurt ourselves. So we looked at those two issues very carefully. And it turned out that the far greater challenge was to have something good enough to care about."

Progressive once again executed well, developing a product that key reviewers saw as superior and wooing users with high-profile content, including C-Span and Fox. RealAudio's brand-recognition obviously didn't hurt – when the first public betas of RealVideo went out in February, its older sibling was already on an estimated 15 million desktops. But the real tipping point was Progressive's ability to point RealAudio's massive user base – clients and servers alike – directly to RealVideo, making it, in effect, an instant default. As Dave Dadekian of

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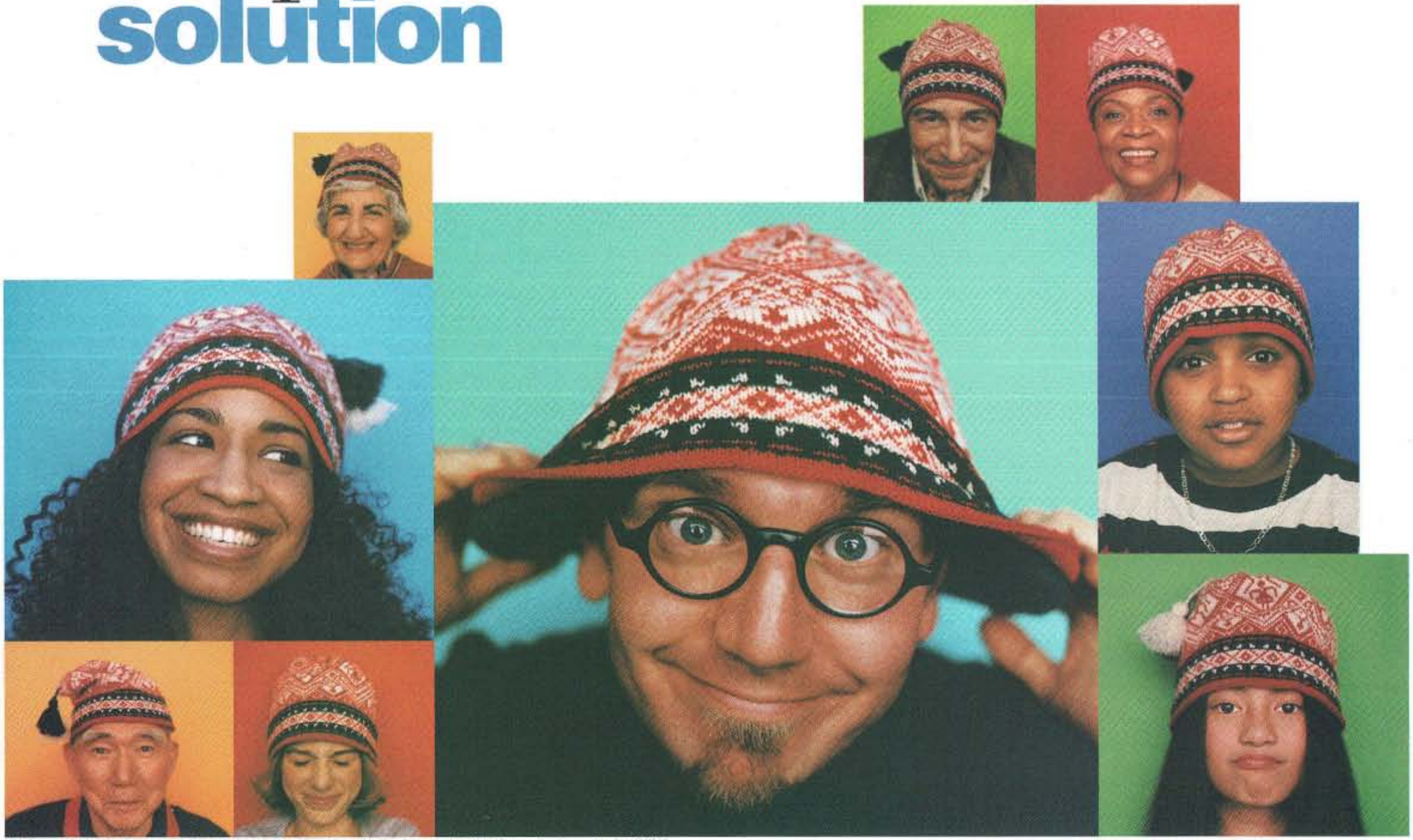

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◀ 182 Fox News Internet Services puts it: "Someone will come out with a slightly better product, then someone else will, and it will probably evolve constantly. But you don't want to require your users to download 40 different plug-ins just to keep up. And you don't want to be constantly changing encoding tools and servers on the back end. So it makes sense to stay with a single, widespread technology."

By the time RealVideo officially launched in February, it looked like Progressive's most serious competition would come not from Internet video pioneers but from Glaser's old friends in Redmond. Though RealAudio was still being bundled with Internet Explorer, Microsoft by then had geared up NetShow, its own streaming audio and video technology. NetShow didn't look or sound as good as RealVideo. And months after its début, it still boasted only a trivial content base – a handful of radio stations and three live video feeds: a SharkCam from Sea World, a SurfCam from a shop in Florida, and a RainCam from Redmond. What it did have was Microsoft's fearsome distributive muscle.

It's not about selling servers: it's about moving TV onto the Net – a $100 billion opportunity.

Glaser was not spooked, in part because of the long list of Microsoft business units Progressive was already working with. "The fact that there are 100 people at Microsoft working on streaming media," he would say, "is not the same thing as a Microsoft jihad."

Still, there were disturbing signs. Months after Progressive rolled out RealAudio's much-improved 3.0 version, Internet Explorer was still being packaged with its relatively dismal-sounding predecessor. Worse, upon downloading Explorer, some users noticed that their RealAudio 3.0 software was actually erased and replaced with the 2.0 version. Honest bungling? Or a ploy aimed at driving users over to NetShow? Soon rumors were circulating that Progressive would be dumped from Explorer altogether.

On a Thursday afternoon in June, Glaser's voicemail fielded a call. "Tell Rob Glaser," a muffled, foreign-sounding – and anonymous – voice said, "that Microsoft is about to acquire VXtreme."

VXtreme? This was no download bugaboo – this was a serious threat. VXtreme was one of Progressive's best-regarded competitors. Technologically, it had some neat tricks, including a quarter-screen display mode at high bandwidths. And unlike most of the rest of the pack, they had lined up some heavyweight content partners, including CNN Interactive and CNET. Glaser did consider the possibility that the whole thing was a Microsoft ploy to scare him into selling. But he quickly concluded: "There were plenty of far more direct and less elaborate channels they could have used to get us to the table."

Glaser phoned his old boss, Paul Maritz, Microsoft group vice president for platforms and applications, and asked if the rumor was true. Maritz confirmed it. "He told me," Glaser says, "that streaming media was becoming such a strategic area, 'Microsoft felt it had to own it.'" Maritz also said that it was their understanding that Progressive 'was not interested in being acquired.'"

That was certainly true. Glaser's stated goal was – and is – to be an independent player on the Internet software scene. He could count on strong relationships throughout Microsoft; he still caught up with Gates himself every few months. Progressive had the market momentum. And possibly the superior technology. So while Progressive and Microsoft had never discussed an equity deal, Glaser felt confident that common ground could be found. The two sides held their first meeting on a Friday, a week after the initial call. By Saturday night, there was a draft agreement. By Monday, they shook hands. On Tuesday, the lawyers signed off.

The terms of the agreement allow Microsoft to fully license Progressive's client and server technology, for undisclosed – but "very significant," as one Progressive source puts it – fees. Microsoft also agreed to bundle the latest RealAudio and RealVideo client software in future releases of Internet Explorer, and Progressive's servers with NetShow developer kits. Microsoft has the right to build upon Progressive's technology but must license back to Progressive any improvements it makes. Microsoft is also forbidden from breaking compatibility between its products and Progressive's – a lesson Glaser learned from Sun Microsystems' ongoing nightmares over Microsoft's licensing of Java. Finally, Microsoft bought a 10 percent nonvoting stake in Progressive. Neither side is commenting on the price, but a knowledgeable source puts it at $25 million.

The Microsoft deal, announced in late July, gives RealVideo a secure place in Internet Explorer, meaning a secure place in Windows – and thus, the PC desktop. To the extent there had been a question about which streaming media product would be the Internet standard, "I think we've flattened it in a very meaningful way," Glaser says.

But there *is* another question: Who really controls RealVideo? Progressive still owns it, but its giant partner now has access to much of the source code. Microsoft can create fancy new streaming-media products and give them away. It can run in its own direction using its old NetShow technology as a base. And it can acquire new technology from Progressive's still lively rivals.

Indeed, the ink was scarcely dry on Glaser's signature when rumors began circulating that Microsoft was on the verge of acquiring VXtreme after all. Glaser was taken a little aback. "My God, what are they going to do?" he said, when asked about all the Internet video technologies suddenly in Redmond's war chest. "Glue them all together?"

The VXtreme deal did in fact go through, in August; Microsoft took the whole company, acquiring a key technology that adjusts streamed video to fit the available bandwidth. But Glaser, a team player – at least a 10-percent one, now – is philosophical: "This isn't a zero-sum struggle for some static, zero-growth market. And it isn't about Microsoft fighting for a slice of a few-hundred-million-dollar server market. It's really about television transitioning from a broadcast to an online form – and that's a hundred-billion-dollar opportunity."

He's right, of course. But a lot needs to happen before that transition can really begin – before anybody will take Internet video seriously. Above all, its image quality will need to improve – dramatically.

Glaser believes this will happen far more quickly than most expect – that by the end of the current decade, on-demand VCR-quality video will be streaming into at 186 ▶

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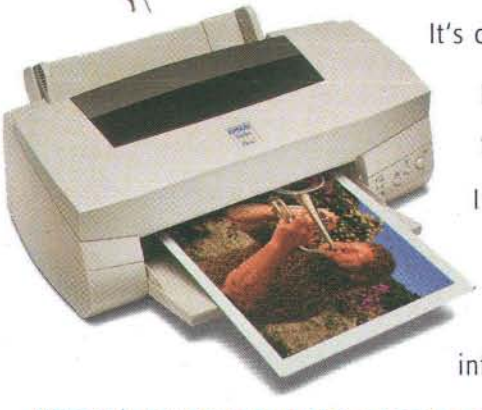

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least some living rooms over the Net.

He cites three forces that will make that happen. The first is Moore's Law: consumer-class computers will have the processing muscle they need to draw richer and richer video streams from a given connection.

A second reason is the forward march of bandwidth. As Glaser points out, even if bandwidth-per-dollar increases at only half the rate of Moore's Law – doubling every three years, rather than every eighteen months – the two effects together "will be additive and very powerful." And the fact is that bandwidth could increase faster – a lot faster. Cable-borne networks like @Home are already bringing the Internet into homes at speeds hundreds of times faster than today's standard fare. Time Warner is rolling out its rival Road Runner service, while telephony companies are prototyping xDSL technologies that may offer equal or even higher speeds over plain old copper. And finally, Microsoft's billion-dollar investment in cable giant Comcast both validates the market and puts TV on notice that high tech's übertitan will not be sitting on the sidelines.

> **For Gates, it's the ultimate battle: extending Windows World to the epic land of television.**

Layered on top of all this will be what Glaser – still a marketer at heart – believes will be the most significant force: the billion-dollar race to put Net-ready video receivers in front of the world's couch potatoes. Microsoft's WebTV is simply an opening shot – Glaser expects to see "some really, really interesting competitive dynamics" as the consumer-electronics industry, cable companies, and telcos all pile on. "If you think Steve Case was in a shoot-out over online access, wait until you get into the battle of the TV attachments," he says. And the hardware, he points out, is just a sideline: "Those devices will be wedded to a particular set of network services. So if you get your device out there, you'll have a recurring revenue of, say, 20 bucks a month from access fees, plus ad revenues, plus pay-per-view fees, plus home shopping revenue on top of that. People will look at that and say, 'Holy shit! What am I doing screwing around, trying to get $300 for a device?' It's like a cell phone – get a subscriber, you get a lock-in."

The result could be "an artificial acceleration of Moore's Law," Glaser predicts, as the awesome value of playing gatekeeper in a turborcharged, Net-based TV-and-every-other-kind-of-media industry jams the field with major players, unleashing a torrent of cross-subsidy dollars, scaling production volumes, and industrial-strength R&D. "The price per mips could then drop faster on the set-top than on the desktop. I give that a 60 percent to 70 percent chance. And if it does, wow – hold onto your hat." Even if it doesn't, he says flatly, "there is no doubt that after the turn of the century, every new TV that is sold will be an IP device."

Of course, the maximum Web=TV scenario injects a certain dramatic tension into the Net – a medium cherished by many of its pioneers as the antithesis of centralized Big Media. After all, technologies like RealVideo do ultimately promise to hand the Net's keys – or more precisely, blow open its doors – to Murdoch, Malone, and other deep-pocketed media barons, whose production and marketing budgets dwarf those of any pure-play Internet content company.

And what happens then to the once-imagined democratized legions of a billion publishers? Will garage-based Java jocks have a prayer of being seen through the all the flashing lights and connecting with an audience? Glaser believes they will – in part because what we now call TV will undergo an even more profound change: "It will be much more wide open, much more decentralized, much more personalized, with a range of choices much more like what you see on a magazine stand than in a world where John Malone or your local cable operator is the gatekeeper."

So the big guns aren't *necessarily* in trouble. "If Rupert Murdoch is adding value because *The X-Files* looks great and has great storytelling, great actors, great pacing and suspense, then Murdoch will hang onto his position," Glaser says. "But if he has his position only because he's crowding out people who can't get onto the broadcast or cable shelf, he'll be diminished. Likewise, if *Suck.com* is funny, irreverent, provocative, and interesting, those attributes won't be diminished by the emergence of more audiovisual content on the Web. And as *Suck.com* becomes bigger and more popular and better, the people who run it can decide for themselves whether to add A/V richness, or whether that's really the antithesis of what they're doing."

So there it is: the Net will let players on both ends of the spectrum find avenues to audiences that don't yet exist. Garage-based guerrilla video artists will be able to build global followings. And Rupert Murdoch will no longer be at the mercy of Ted Turner or any other pipe-owning rival. Content producers of all stripes win big. So do consumers, who will enjoy an explosion of content and an empowering shift in its accessibility.

Forms of content that either can't get carriage in the present distribution network – or literally can't exist within it – will flourish. Glaser commissioned the three Spike Lee shorts in part to prove a point: the film short, a powerful form with a vibrant past, has virtually no *present,* because it lacks a mass distribution channel. We no longer see shorts at the movies, we see marketing-driven previews. They don't fit TV timetables, outside of MTV. But the form resonates perfectly with the jumpy attention spans of media surfers. Not to mention the lower-than-Spielberg-class budgets of most new media producers. And on the Net, the space for them is infinite.

Some old forms will have problems adapting. One likely casualty is the notion of networks as linear, round-the-clock processions of programming. Streamed content is infinitely accessible. And that favors what might be called the "branded nonchannel" – an aggregated batch of content that can be viewed at any time, in any order. CNN and C-Span's video-enhanced Web sites are early prototypes. Another might be the ultimate *Star Trek* "channel" – any show, including spinoffs, available whenever you summon it. The result for any one programmer could be far more – or less – than 24 hours of transmissions a day. ESPN might stream out dozens of basketball games, all live, in a single evening. The Abyssinian Cat Fancier Network might post only a few minutes of new video per month. And both models can work economically.

Of course, all of this will be for

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naught should the video-fueled Net go spectacularly supernova, then catastrophically collapse under a deluge of live sports, first-run movies, and sitcom reruns. But Glaser isn't worried. "At the end of the day," he says, "it's all plumbing," and points to an array of bandwidth-optimizing technologies – multicasting, proxy caching, usage-based pricing.

Progressive's RealNetwork, the new service launched with MCI in August, is designed to let more people connect to RealVideo, while at the same time reducing pressure on the backbone. Up to 50,000 streams can be carried simultaneously, enabling content producers to reach audiences that are economically significant, but too small to be reached by cable or satellite. For instance, Glaser estimates that a one-hour show can be streamed to 25,000 people – around the world – daily for just $8,000 a month. The picture is RealVideo 1.0 – far from broadcast quality. But Glaser says MCI "can ramp up the backbone" as needed, to let better pictures reach bigger audiences. ABC News, Atlantic Records, and ESPN are already signed up.

Glaser has a place again at Microsoft's table. He'll get more than crumbs, but how much?

Glaser has history – however brief – on his side. The Net has so far defied repeated predictions that it will choke on its own bits. As the Super Bowl and *Jurassic Park, Part 13* start sluicing through, there will be a lot more – exponentially more – to choke on. But there are worse bets than Glaser's: that the rewards should the system survive are huge enough to ensure that it will.

So if there is ample room for both Murdoch and *Suck* on the broadband, video-injected 21st-century Internet, what kind of space will there be for Rob Glaser? In high tech's odd world of alliance-based competition, the answer will largely hang on the delicate dance he has entered with his old friends in Redmond. Microsoft has given Progressive its blessing – no small thing. But Microsoft could also crush Progressive, just as it has crushed so many first-to-market innovators and even partners. Gates can pour hundreds more engineers into streaming technology. Having digested VXtreme, he can buy up everyone else in the market, then mine their code for proprietary gems. He can build stronger, faster, more stable products than anyone else, then give them away with the purchase of a small drink and fries.

It's no secret that Microsoft is never the easiest bedfellow. "If we don't execute well, it could turn out to be a bad deal," Glaser concedes. "But face it – if we don't execute well, we would have been in just as much trouble without the deal. And if we do execute – if we keep driving our standards forward independently and remain at the forefront of the market and the technology – it'll turn out to be an amazing deal. There are pitfalls. But if you want a sure thing, you should take a job at the post office, right?"

Glaser is no postal worker. And having spent most of his working life in Redmond, he is no John Sculley or Jim Manzi. He knows how the machine operates. And in the present battle, he understands how high the stakes are and where the real lines of competition lie.

Microsoft built one of the most powerful franchises in history by becoming the toll-collector on the PC desktop. Now there is another, potentially far more valuable piece of territory up for grabs – interactive Net-enabled television. Microsoft wants that, too, and has been jockeying with the broadcast industry – not to mention its consumer-electronics partners – about who will set the rules. It is a titanic struggle – one that could extend Windows World from the current 35 million US homes with PCs to the 97 million that have televisions. Not to mention the rest of the world. And if doing that means giving a few players from "the competition" seats at the table rather than shoving them onto platters, Bill Gates can certainly afford it.

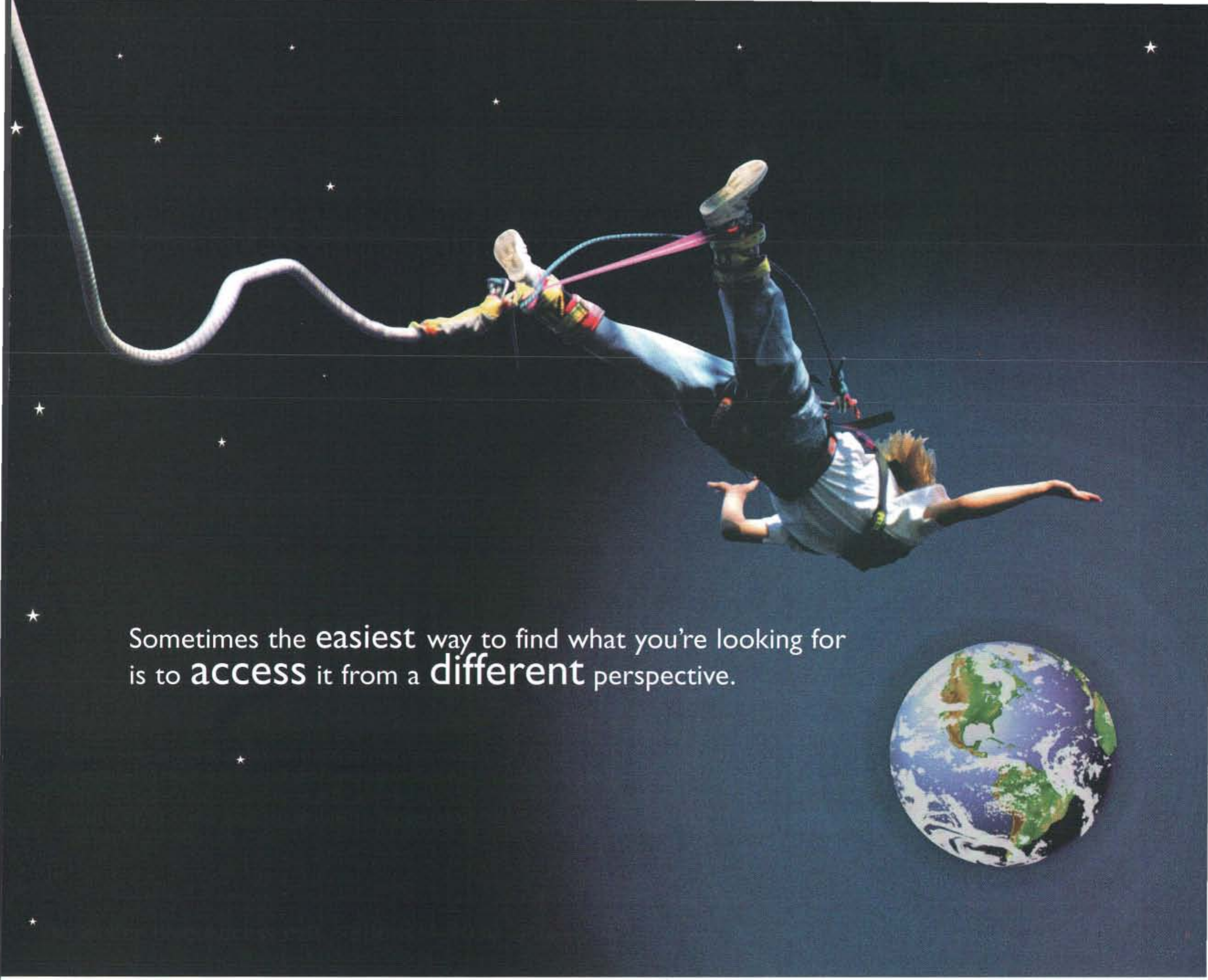
And Glaser is sure to come away with more than just crumbs. Since the initial syndication, Progressive has had two additional rounds of financing, the first in October 1995 by Accel Partners, the second in December 1996, led by Goldman Sachs and Merrill Lynch. Along with slices of stock for key employees – and now Microsoft's investment – these have almost certainly left Glaser with a minority stake in his company, whose value is currently estimated at more than $250 million. For now, Microsoft's check in the bank means plenty of money in Progressive's till. But at some point an IPO is nearly certain, as the stakes – and the capital demands – of the Internet-video game rise. That could still make his position worth well north of $100 million – not quite the billionaire boys' club, but not bad for three years' work.

But while an IPO may be looming, "sellout" doesn't seem to be part of Glaser's vocabulary. Wholesale acquisition, he says, by Microsoft or anyone else, would only happen "in such an usual situation that I can't even contemplate what it would be. Progressive is where I see myself in 10 years, 20 years – basically, however far I see."

And his old field of activist dreams? Glaser says Progressive may flirt around the edges of content, but the furthest it's likely to stray from software, networks, and tools is aggregating other people's programming. The company already runs a service called Timecast, a Yahoo!-like showcase for RealMedia resources on the Web. It also funds WebActive, a Net-based clearinghouse for political activism ("Julia-Louis Dreyfus says: Become an email activist for the Environmental Defense Fund"). During the July 1 handover of Hong Kong to China, Progressive put together a special RealVideo resource site, complete with that deeply credentialed progressive Henry Kissinger gushing in a press release: "For someone like me who wants to stay current about events, these RealAudio and RealVideo broadcasts are invaluable."

But whatever Progressive ultimately becomes – Internet standard-setter, protonetwork, or another notch in Bill Gates's deeply rutted scabbard – Rob Glaser's life-after-Microsoft project has already done more to transform the Web's media environment than any technology, with the (possible) exception of Java. Comparing the Web today with its 1995 counterpart is not unlike comparing, say, the first Technicolor epics with a silent film. And as Glaser likes to point out, the real changes are still to come.

So there is plenty of time for an Act III, if Glaser wants it. And meanwhile, there's another keynote or four to prepare for auditoriums full of true believers, each wanting to see allofthedemos – and maybesomenewones. ■ ■ ■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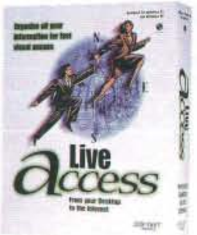

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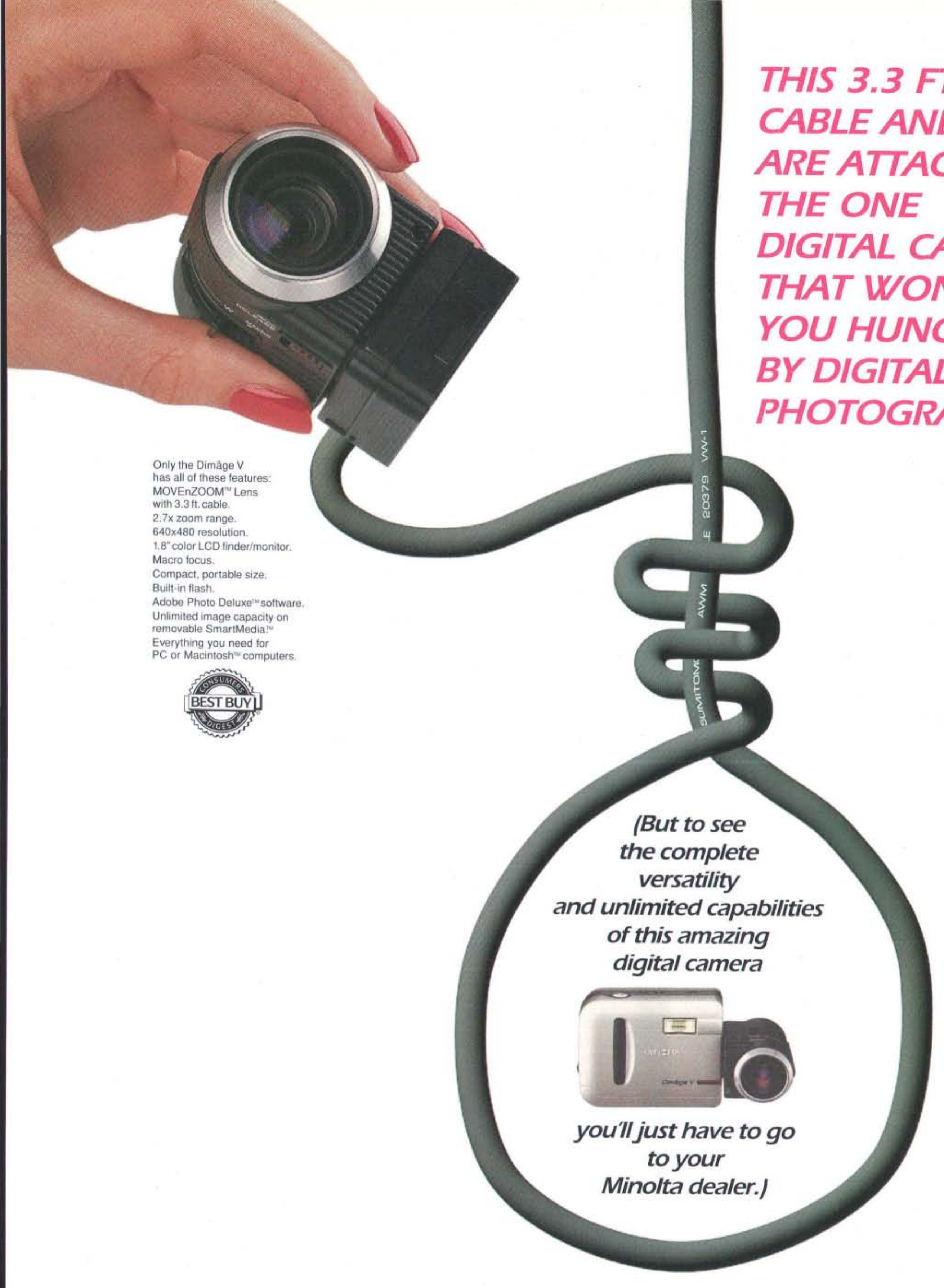

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Hydrogen

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Instead of building large plants whose capacity will not be fully tapped for years, suppliers will probably find it cheaper to augment central electricity supplies with power from modular fuel cell units located near the point of consumption. These fuel cell generators, which emit no noise and only trace pollution, can be placed close to consumers without violating local noise and pollution ordinances.

Deregulation will also prompt electrical "productization": instead of having to rely on electricity from the grid, consumers will be offered varied qualities of electricity. In particular, users who now deal with grid outages will have access to the more reliable electricity supply of fuel cell generators. Though the cost per kilowatt of these generators is likely at first to be much higher than that of conventional power plants, their superior reliability and quality should attract many buyers, including an array of high tech manufacturers for whom dependable power is critical.

The distributed power provided by fuel cells could alter political relationships, strengthening remote areas and weakening central authorities.

International Fuel Cells's success in selling its generators seems to confirm this assumption: although the units' subsidized price - $2,000 per kilowatt - is substantially above the $500-to-$1,500-per-kilowatt range of conventional power plants, IFC has sold 140 units and has received orders for 185 more. Fuel cell manufacturers are counting on continued technological innovations and economies of scale to bring about huge price reductions in generators, just as in fuel cell cars.

These next-generation generators may be particularly popular in developing nations, where capital for large conventional power plants is in short supply and debilitating air pollution is widespread. Joseph J. Romm, the DOE's acting assistant energy secretary for energy efficiency and renewable energy, says, "Just as some countries are bypassing a nationwide system of telephone lines and leapfrogging to cellular, we'll see countries bypass a nationwide system of big central-station power plants and extensive power lines and leapfrog directly to distributed power" provided by fuel cells. That, in turn, could alter political relationships, strengthening remote areas and weakening central authorities.

"The market for stationary fuel cell applications is potentially bigger than the car market," says Lancaster. Indeed, H Power, a Belleville, New Jersey, fuel cell manufacturer, estimates that sales of on-site fuel cell power generators will reach at least $2 billion by 2005. To feed that market, Ballard is developing a 250-kilowatt generator, big enough to power a small hotel or strip mall, that is slated for commercial sales around 2002. Energy Research Corporation of Danbury, Connecticut, plans to put a 2.85-megawatt fuel cell plant, which can power 1,500 homes, on the market within a year or two after that.

"Power plants are going to be just like furnaces," says Joe Maceda of Power Technologies. "They're going to be appliances." One day you may be able to drive your fuel cell car during the day, then connect the car's engine to your house to provide heat and electricity at night. Alternatively, electricity generated by the engine could be fed to the grid in return for credit. Thanks to the fuel cell engine's efficiency and reliability, an asset that usually sits idle for all but an hour or two a day could become a steady income earner.

Even if this scenario doesn't become reality for several decades, the links between automotive and stationary fuel cells suggest a strong synergy. "The car industry and the stationary power industry are both so huge that if one of them adopts fuel cells, it will pull the other one into the market," says Toyota's Bill Reinert. "It is probably too early to say that fuel cells will be a climax technology, but it sure seems like they will." ■ ■ ■

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Genome

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name. As do the processes by which they interact, as do the techniques by which those processes are elucidated – all heavily acronymized. "Upon oligomerization of TNFR-1 by trimeric TNF, TRADD is recruited to the receptor signaling complex. TRADD can then bind TRAF2, RIP, and FADD," reads a recent piece in *Science*. Uh-huh. I scribble notes, hoping to figure it out later.

By dinnertime the next evening, I'm feeling a lot better, having boned up on the jargon and prevailed on a substantial number of strangers to give me minicourses in their life's work. They seem happy to do this; most of them have a memorized speech communicating the technicalities of their work in room-temperature terms. I ask Brent about this. Maybe it's the venture capitalists, he suggests: biotech people are deluged with offers of funding, and they get good at explaining to nonscientists what they do. Brent and other academics here get daily cold calls from VCs: "What're you doing? Anything hot? What do you need?" The financial market senses something immense growing out there, and despite some much-publicized failures over the past decade, the money guys are still flinging their darts, hoping to pop Something Big.

Man and Superman

Unless you take a special interest in exotic pharmaceuticals or genetically engineered vegetables, you might be wondering what happened to the biotech revolution. That's about to change, says a leading biotech researcher, who made some off-the-record predictions for *Wired*.

2003	Human-genome sequencing completed.
2000+	Artificially engineered DNA used routinely to treat defects in human cells.
2000+	Desktop genetic testing available in hospitals and clinics.
2000+	Genetic therapy for cancer and other genetic diseases becomes widespread.
2000+	Inherited traits in mammals successfully altered in the laboratory.
2010+	Alteration of inherited traits in mammals is routine.
2010+	Complex (polygenic) human traits, including intelligence and longevity, are fully understood.
2010+	Alteration of inherited human traits becomes a major political issue.
2015+	Genetic engineering widely used to eliminate disease-causing defects, paid for by public-health programs and private health insurance.
2020+	Inherited human traits are routinely altered for nonmedical reasons.
2030+	First generation of children altered for intelligence, longevity, and appearance approach maturity; genetic engineering begins to have profound impact on the human experience.

As the presentations roll by in the semi-darkness, I fight somnolence with coffee and begin to discern two big themes. The first is the industrialization of a set of technologies that had always been a kind of hand craft, performed by people in the traditional white lab coats – dull, slow, work growing immense numbers of unicellular organisms and cutting strands of DNA into tiny pieces, then adding a snip of potentially interesting DNA or perhaps some gene-modifying chemical and watching what happens. We heard a lot about automating and increasing the sensitivity of the assaying gear – the better you can detect a particular molecule, the less you have to amplify it to make it show up. Much of biotech depends on the Lego-like qualities of biomolecules – if you get the surfaces right, they snap together. So you can, for example, set a trap for a particular protein or nucleotide by labeling a "bait" that will lock on and show up on a detector.

The other theme is the blossoming romance between biology and the computer, a jointure called bioinformatics, which is driven by the drug business's grim regulatory economics. The pharmas will spend a combined $19 billion this year on R&D. To develop a single drug from a bright idea to something a doctor can prescribe typically costs between $360 million and $500 million and takes an average of *15 years*.

The journey traditionally begins with the medicinal chemists, who spend whole careers making one likely organic molecule after another (at the rate of 100 to 150 a year per chemist). When a potential target is located – for example, a misbehaving or pathogenic protein – the molecule cabinet is opened and chemicals that might lock on to the target's active face are tried out in the lab, one by one, by those folks in the white coats. The few chemicals that seem to work *in vitro* (in glass, in the lab) are then tried out on animals. Such *in vivo* experiments can go on for years; the project crashes if the potential drug turns out to be ineffective or toxic.

For the few drugs that survive, more years of clinical – human – trials follow. Until the Food and Drug Administration signs off, the pharma cannot make a dime in the US. And even with an FDA green light, the pharma *still* might not make a dime. Only 3 out of 10 drugs ever earn back their R&D costs. In this environment, any technology that significantly ups those odds – that speeds drug targeting or improves the hit rate – is a diamond mine.

A funny kind of frontier, then, dominated by giant pharmas, which are themselves constrained by a ponderous and ultracautious federal bureaucracy. The participants here seem to reflect this. They are cautious, calm, reflective, wary about sharing details of their work. Sure, we have the Hawaiian shirts, the leather vests, the feathers in hats, the all-black urban stuff – this is not, after all, a vinyl-siding convention. But my anarchism meter has not stirred.

On a break I seek out Karen Hopkin, a reporter for *The Journal of NIH Research*, and, not incidentally, the creator of *Studmuffins of Science*, a calendar featuring pinups of scantily clad, brainy hunks.

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Genome

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Hopkin, arguably the most anarchic person in the room, doesn't think a biogeek culture exists, mainly because it takes a relatively long time to get good at biology. There's a lot of respect for people who have been doing it for a long time, because they are still making contributions. You don't have these 15-year-olds who know it all. People in biology are older, they have *lives*, so your basic prank is lightweight: making squirters out of dry ice and ethanol, slipping orange juice into urine samples, things like that. Besides, if you're *actually* in the process of turning the world upside down, it may obviate the urge to break into some Air Force computer and steal a landing-gear repair manual. Ian Wilmut is easily distinguishable as a personality from Kevin Mitnick or Steve Jobs. A frontier with no cowboys? I'm missing something.

Maybe it's because biotech is so *different*. One of the forces that drive the cowboy or the computer hacker is the sheer addictive power of a new technology, the sense of total, solo control – 48 hours in front of the screen, living on Twinkies and Jolt. You don't really get that in biology, because whatever wonders you accomplish, it's never really solo. In a very real sense, you always have a partner, life itself – you have to wait to see what the organism will do. That takes a lot of the thrill out of the game: you're not in total control.

Biotechnology isn't for soloists. You always have a partner, life itself – you have to wait to see what the organism will do.

Moreover, the connection between genetic code and its output is infinitely more complex and indirect than the analogous connection between software and what a computer does. And finally, there's the mystery, the sense of wheels within wheels, of things unseen that you haven't quite pinned down – a humbling that seems to produce priests rather than cowboys. Not, of course, that biologists can't be as arrogant as anyone in science – and this increases, the more molecular and the less organismic the research. But all in all, training as a biologist tends to be sobering.

Back at the conference, the session has turned to the peculiar little software industry growing up around the pharmas. The basic idea of bioinformatics is simple: instead of laboriously making and testing hundreds of compounds, you use computer simulation – research "in silico," as some call it – to zero in on those most likely to work. And where that leads is what the pharmas call rational drug design. (See "Rational Drug Design," *Wired* 5.04, page 80.) From a sequenced gene, you derive an amino acid chain. The chain provides the relevant protein and its active sites, which you then use as a sort of template to design the drug. The big stumbling block is the so-called Folding Problem – how to go from the code for maybe tens of thousands of amino acids strung along in a nice neat row to the actual protein's intricate shape and surface. The standard texts suggest that this is computationally impossible. (Get 20 different kinds of rubber bands – fat ones, thin ones, little ones, big ones – tie a couple thousand of them together in a long string, and stretch them. Now, quick, try to predict the precise shape of the pile that will result when they snap back together. Hard? Cube that, and you have something close to the Folding Problem.)

But after dinner the third night, with my margarita level falling dangerously low, I decide to explore the Folding Problem in the hotel bar with two people I have selected as the Closest Thing to Cowboys and the Oddest Conference Couple. Art and Sue Weininger are married and run a two-person firm called Exonix. They have no physical plant. Instead, they flit from Silicon Valley to San Francisco to Seattle, using ad hoc teams at contract labs and cranking out the necessary data and studies, all of which comes together in their computers.

He's a large, dark, bearded programmer from New York who looks as if he could be one of the Flying Karamazov Brothers. She's a small straw blond with pale blue eyes who wouldn't appear out of place posing with a prize heifer at the Iowa State Fair. They met scuba diving in the Caribbean, but it is clearly a marriage made in heaven, with major participation from Wall Street – a literal marriage between computing and biology. Sue mentions in passing that their firm has product worth $1.2 billion. I set up another round and put the Folding Problem to her. She answers with a 10-minute protein lecture of such intensity and erudition that I feel my face start to tan. The short version is this: software will be available to solve protein folding by 2000. If she's right, we will (ultimately) be able to make proteins *to order*, a technological advance on the scale of, say, the transistor. No big thing in this crowd.

But it *is* a big thing, an immense thing, *if it works*. This is the problem. The hype that afflicts the software industry is nothing, compared with biotech's bombast. Everything conceivable in the biologic realm has been discussed, worried over, science-fictionalized half to death. Of course, we'll cure all disease, live forever, change our shapes, have feathers, grow gills and dwell beneath the sea – ho hum, tell me something I don't know. The hype is like the 19th-century penny dreadfuls that purported to inform the stay-at-homes about the Western frontier – it has about as much relation to the reality of today's biotech people as those tall tales did to some flea-ridden, exhausted cowhand in 1889 Wyoming.

Maybe a tighter focus will help here. Tom Meade, the only man at the conference wearing a regular business suit, seems an apt choice – he's talking about hooking DNA to electronic sensors. Meade is pleasant-looking, diffident, middle-aged, a Caltech professor who discovered some years ago that under the right conditions, DNA conducts electricity: that is, you could shoot electrons down the center of an intact double helix. Based on this discovery, Meade and a postdoctoral fellow named Jon Kayyem founded a start-up, Clinical Micro Sensors.

The firm, I discover later when I visit, is housed in a concrete-block building in the old part of Pasadena, just up the street from a Salvation Army outpost. Kayyem, a gentle-looking, tall, olive-skinned scion of the

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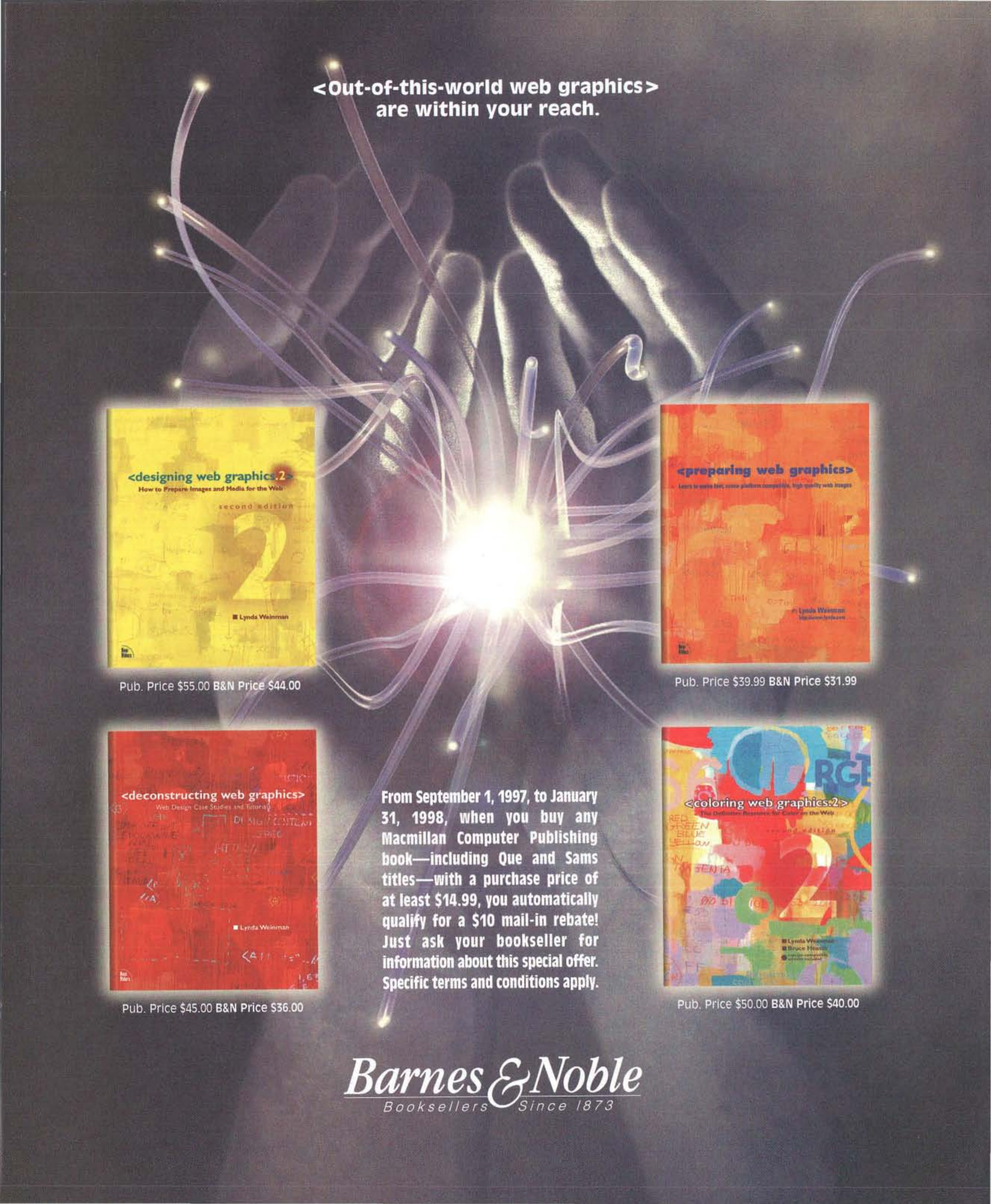

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Genome

◄ 194 great Lebanese diaspora, gives me the five-minute tour: organic lab, bio lab, computer room. Biotech is visually unexciting. A time-lapse film of a cutting-edge operation would show a largely empty room with a good deal of glassware and silent, boxy machines. At long intervals, a person in a lab coat walks in and pours vials of colorless liquid into other vials of colorless liquid. I mention this to Kayyem, who agrees, but adds that his operation uses metallic compounds, so that some liquids are colored. The blood races!

In the computer room, I meet a couple of people working with chips, gilded rectangular wafers somewhat smaller than postage stamps, each sitting in a beaker of, yes, colorless liquid. What Clinical Micro Sensors does is "solder" a metallic compound to the end of a single-stranded DNA sequence and connect it to a custom-made computer chip. When finished, each chip has thousands of little DNA half-chain molecules sticking up from it, waving in a liquid bath like the fronds of a kelp forest.

Biotech is serious in a way that most computer stuff simply is not. This is screwing around with the meat puppet – a sobering proposition.

The proposed device works on the discovery that electrons travel faster (technically, impedance is reduced) down a complete double helix than they do down a single strand. If the sequence used is from, say, the human immunodeficiency virus that causes AIDS, and your test sample also contains that sequence, then the sample will mate with the chip DNA, transforming it into a double helix, and you will see lower impedance, using the fairly standard electronics to which the chip is connected. The more viral sequence in the test sample, the lower the impedance. It now takes weeks to get a viral load reading from a blood sample sent to a lab; the device Kayyem is working on can produce the same result in minutes.

This technology would be to medical diagnostics what the ability to program onscreen instead of batch processing was to software development. *Revolutionary* is an abused word in biotech, but here it is entirely apposite. Are the venture capitalists lining up? Not exactly, Kayyem says ruefully. The wave has already moved on, and investors want to know when he will have a *handheld* version. "The hype element is so great in this field," Kayyem explains, "that it's interfering with the development of actual products. As soon as somebody makes an announcement that they're pursuing something, the field adjusts to assume that the thing already exists, and they want something even sexier. It's really strange."

Indeed. And unlike software, a medical product can't just be tossed out on the market to sink or swim and annoy users with its bugs. The FDA frowns on this. Here is another reason the cowboy style is suppressed in biotech: this is *serious* in a way that most computer stuff simply is not. This is screwing around with the meat puppet itself, ever a sobering proposition. I put this thought to Kayyem and ask him about the apparent absence of biotech mavericks. He went to Caltech, after all, one of the world's great nerd incubators. What were the differences between the programmers and the biologists?

"Well for one thing, on the undergraduate level, we had the premeds, so that most of us were planning to work inside the most conservative hierarchy there is outside the church." That makes sense. Premeds can get pretty wild, but there's a limit; the truly weird get culled early.

"The other thing," he continues, reflecting, "is that, unlike the computer people, we had women."

You mean you had sex?

He laughs. "Oh, no, I mean there were female students, both undergraduate and graduate, in some fairly high proportion. It makes for a different social setting."

This also makes sense. On their own, adolescent-type males will get into shenanigans they wouldn't dream of doing with women around. Cowboy culture thrives in an all-male setting. (Sociological note: the biotech gender gap is probably smaller than it is in any other high tech field. If the gear ever gets cheap enough to allow teenagers to snap proteins together in the garage, your prototypical gene hacker is as likely to be a girl as a boy.)

Still, something's missing here, a piece that would explain the odd calm in the midst of this enormous revolution. We start talking again about Kayyem's technology. He says he expects to have his first working prototype in around two years.

"We think it's going to be very important to the AIDS community, the ability to check viral loadings immediately. A lot of AIDS treatment is adjusting the mix of drugs, and the amount of virus you have is the best indication that the treatments are working. Also, there's a lot of self-treatment that goes on. You read about it on the Net all the time. People say, Oh, I changed my diet, I did this or that, and I feel much better. Now they'll be able to tell whether they really *are* reducing the viral load."

And beyond that?

"Well, you can test for anything, really. You could have a suite of chips that could test for all sexually transmitted diseases, for example. Or one for biological contaminants in food. Ultimately, of course, you can do genetic screening in an office, more or less while you wait."

Gulp. Cheap, quick diagnosis is just one example of what the new machinery will be able to do. Where is this going to end up? Will teenage kids indeed be able to mess around with genes in the garage?

Here he's a lot more cautious. "I wouldn't go that far right now. But five years ago, no one would have said we could 'solder' DNA to a computer chip. On the market side, there's a definite movement toward people taking on their own treatment. The AIDS people were the pioneers, but there's really no limit to what people want to do for themselves – diabetics, people watching their cholesterol, anyone on a drug regimen."

Kayyem seems to be speculating about as far out as he's comfortable going, so I don't press him any further. Still, on the plane home it occurs to me that once you start talking about hooking DNA directly to electronics, you raise the remote but 198 ►

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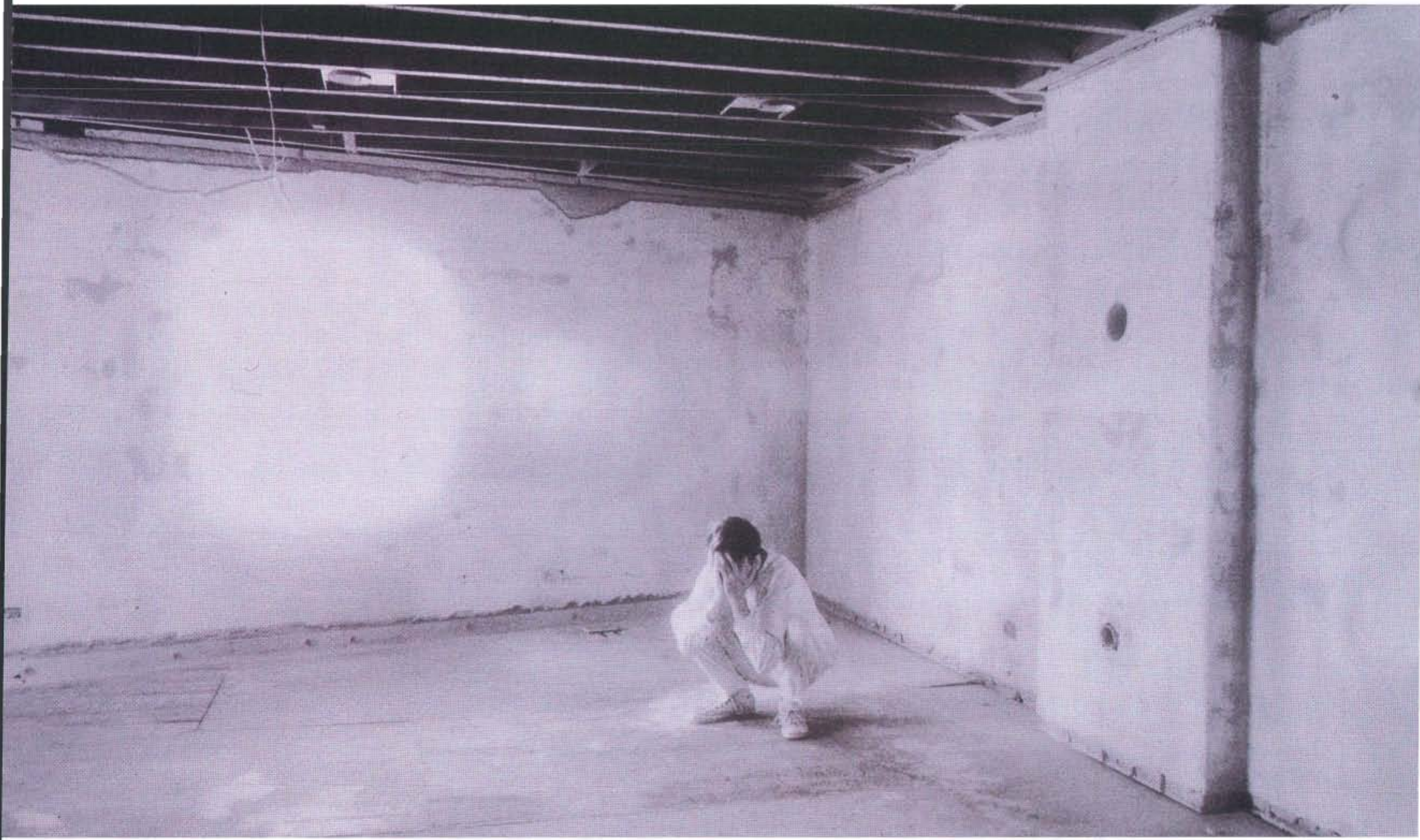

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Genome

◄ 196 fascinating possibility of linking the speed of computers to the gargantuan information-storage and -processing capacity of living molecules. A 22nd-century technology, maybe.

But it is while musing about the extreme long term that I come up with another explanation, maybe the key one, for why the biotech frontier is not a frontier at all – yet. I had made a scaling mistake, simply because what's happening now is so very large that it's hard to obtain perspective. The analogy I began with – the electronic revolution – was wrong. You don't get a proper frontier until you have a workable technology in hand, something an ordinary individual can use and adapt: the printing press, the six-gun, the cheap biplane, the personal computer. Where we are in biotech is a much earlier stage – it's the age of exploration, of Plymouth Rock and colonial Williamsburg, Moctezuma and Cortés. Huge corporate entities are sending out teams of explorers to claim blank places on the map, where it says "Heere be dragons." The biotech start-ups are not two guys in a garage like Apple; they're more like the well-funded caravels of Magellan and Drake, outriders of competing empires.

Historical analogy is always risky, but let's try: the 21st century will be more like the 16th, with biology standing in for the New World.

Historical analogy is always risky, but let's push this: the 21st century will be more like the 16th than like the 20th, with biology standing in for the New World. The pharmas and the big chemical companies are the great expeditionaries – Cortés, Pizarro, de Soto, Raleigh, and so on. Government regulatory agencies are – what else? – the European imperial powers. The pharmas are after treasure, of course. The regulators want to keep control, which they express as an overarching social good – back then it was Defense of the Realm and Propagation of the Faith; today it's Public Health.

Historically, two models emerged: the Spanish and the French ran tightly controlled mercantile-military operations with no local autonomy to speak of and a small élite ruling a large, inert mass of peons. The British, by contrast, chartered looser outfits – gentlemen adventurers, entrepreneurial land barons, church groups – and stocked their colonies with criminals, exiled rebels, religious nuts. It was the offspring of this interesting mix who made the American Revolution and the frontier society that followed: thousands of ornery rascals lighting out for the territory, cheap firearms in their hands and their eyes on the main chance. Pioneers. Mountain men.

But biology? What would it take to transform the clubby little world of biotech into a true frontier – bursting, incoherent, out-of-control enterprise, including the garage-based teen gene hacker? First, you'd need that cheap unit, the biotech Colt Peacemaker or Apple II: push a button, fiddle with a biochemical, test it, fiddle some more, get something you can use. We're a long way from that now (although who knows what *long* means anymore?). But maybe one day some marriage between the analytic software dozens of small firms are now pushing and the kind of machines Jon Kayyem has in his sights will spawn a truly revolutionary biobox.

The second thing you would need is instant results: the hacker wants code that does something neat. So what could the biobox do? How about body modification, for starters? How about untraceable psychoactive substances, optimized for individuals: Make her fall in love with you! And if that doesn't work? Fix your brain so you won't care!

The third thing you need is the government either helping (as on the actual Old West frontier) or on the snooze, as it was when the PC was being developed. That won't happen anytime soon. The big, industrialized economies are committed to the Spanish Empire school of exploration, which means that for the near future, it's going to be a big boy's game, and the typical player is going to look a lot more like Hernán Cortés than Daniel Boone. Not a happy thought. Certainly the feckless cowboy/hacker is far more congenial to the modern way of thinking than the conquistador, especially since, if the trope is correct, we're all Aztecs and Shawnee. It's enough to make one look more benignly on the horrible old FDA as it "stifles private enterprise."

Lest we forget, by the way, the golden age of exploration also included the biggest uncontrolled *biological* experiment in human history. Introduced diseases reduced the New World's indigenous population some 90 percent. A monster gene-mix party occurred among the survivors and the newcomers. And there was a worldwide redistribution of plants and animals that both destroyed or modified whole ecosystems and provided sustenance for millions who would have otherwise starved or never been born.

We should not expect the coming century to offer changes any less dramatic. The world this new age of exploration will usher in, the world after the genome, will be less like ours than ours is like the Bronze Age. The bright, confident, serious people of After the Genome 2 are the fathers and mothers of something enormous, and they are immensely more scary in their ordered way than the most anarchic cyberpunk hacker ever born. They are laying the groundwork for what Bruce Sterling calls, chillingly, the posthuman. I suppose your take on this has to be intensely personal, depending on what you imagine: a long, long, long happy lifetime in a Second Eden, or a grim Brave New World under the thumb of the malign heirs of Squibb and Glaxo.

We can't tell which it will be, any more than the European monarchs who launched the little ships could predict Chicago. They, too, thought it was only a gold rush.

The word that keeps flitting through my mind is one that, appropriately enough, came out of the 16th century. It's the term used in Italy during the Renaissance to connote the ambiguous feelings roused by mighty forces beyond the normal human scale: *la terribilità*. The steel mill flares, the volcano erupts, the fully armed F-16 shoots into the sky, Genesis itself cranks up again in the colorless fluid. How horrible, we say, how marvelous! ■ ■ ■

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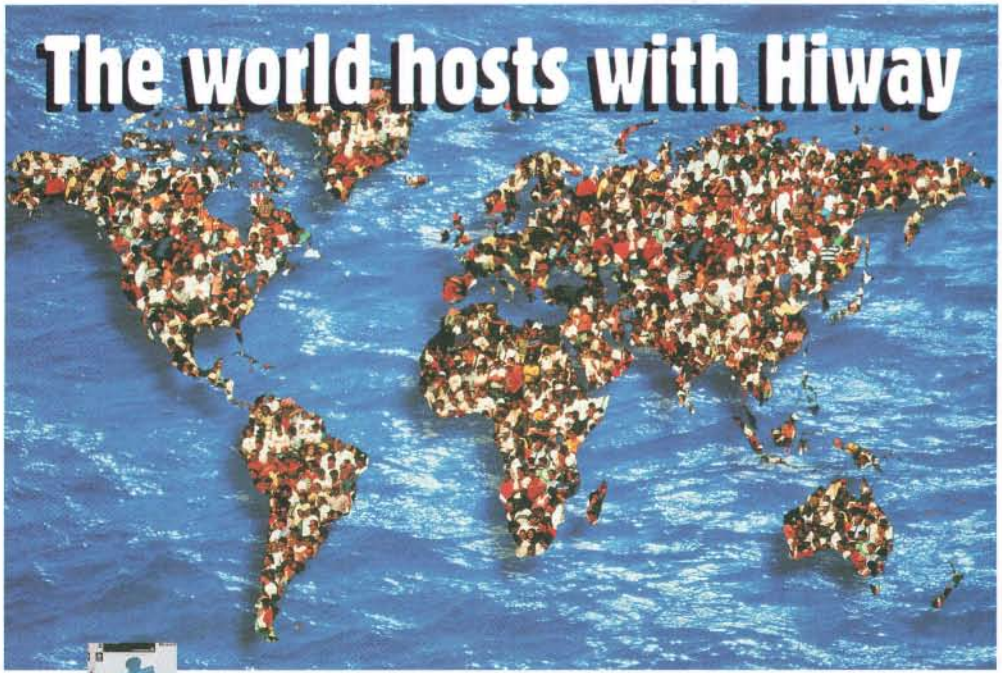
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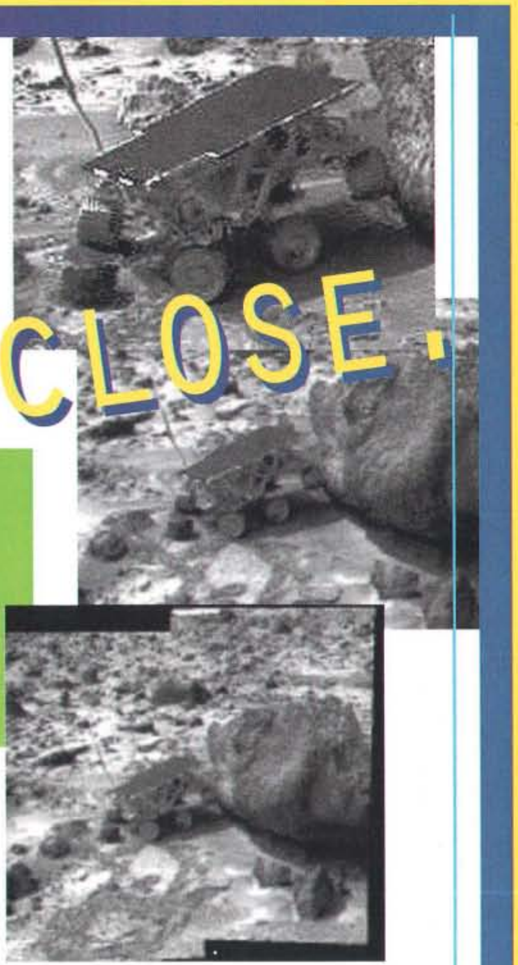

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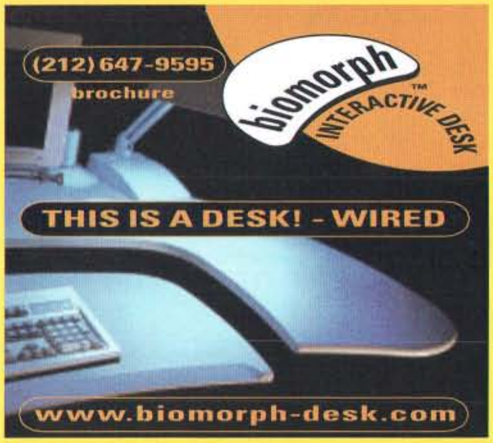

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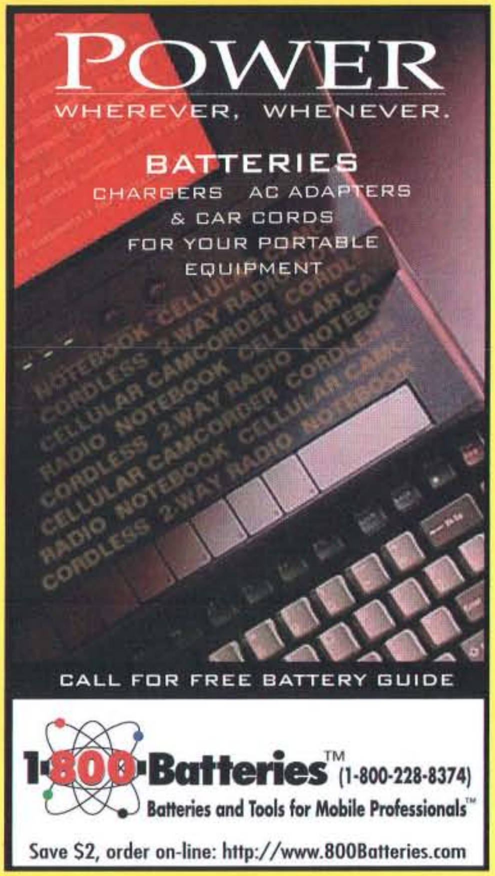

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who view the regulations as a worthy sacrifice to make on the altar of national security is just as wide as it is on the Hill. In the balkanized bureaucracies of the White House, many staffers working on trade-oriented issues would like fewer restrictions on encryption, while those who specialize in crime and punishment want more. "Ultimately, it's something of a generational gap," says one young administration official who follows crypto policy. "The older generation has been groomed with crises – they understand conflict in a way that younger people don't. But the younger people who get this stuff understand that the policy is no good if other countries don't follow it."

Indeed, the international dimension of the crypto debate may ultimately moot the position of the hard-liners. Despite the administration's insistence to the contrary, other countries are, for the most part, not playing by American rules. During a July conference of European ministers in Bonn, US Commerce Secretary William Daley failed to persuade the Germans – our leading competitor in encryption software development – that every country should restrict exports, and that every citizen should be urged to hand over copies of their encryption keys to a government-approved source. But the most ironic failure of the US export policy came in May, when Sun Microsystems signed a deal with Elvis+, a Russian software firm staffed with refugees from the Soviet space program, to manufacture strong crypto without key recovery and sell it internationally – including within the United States.

Against this backdrop, plunging into the encryption policy quagmire is hardly a good career move for any US government official. And with no resolution in sight between those within the administration who side with industry and those who favor law enforcement, encryption has become a hot potato no one wants to touch. "I asked a long time ago what this crypto stuff was," says one official who has a hand in several aspects of Internet policy. "Everyone told me, 'You don't want to know.'"

No one understands this better than Ira Magaziner, Clinton's senior policy adviser on Internet affairs and chief architect of the White House's recently released Framework for Global Electronic Commerce. In attempting to construct the administration's ecommerce policy, Magaziner was left with the unenviable task of trying to fit a square peg into a round hole by jamming a strict export control policy into a document that otherwise takes a strikingly hands-off approach to the Internet. Magaziner is clearly uncomfortable with the disconnect. Publicly, he is careful to toe the administration party line that "there must be a balance between data protection and national security concerns." But in private, Magaziner has not been shy about expressing his disagreement with the administration's crypto stance and its plans to build a domestic key recovery infrastructure – plans that have been grafted onto the McCain-Kerrey Senate bill.

Remarkably, the worst may be yet to come. At the House International Relations Committee meeting in July where the supercops received the royal treatment, the committee chair, Republican Representative Benjamin Gilman of New York, offered an amendment that would ban the sale, use, and import of strong encryption. Although the amendment failed, it put Internet advocates on notice that the House may also be vulnerable to the crypto paranoia that has already infected the Senate. "It's the first time we've gotten a glimpse of where this could be going," says the Center for Democracy and Technology's Alan Davidson. "It's a potentially very scary future."

The wide gap that separates the thought processes of fear and opportunity foreshadows a bigger showdown on encryption policy. Though it now seems unlikely that *any* crypto legislation will pass during the 105th Congress, it's even less likely that the president would sign a bill that seeks to liberalize US policy. But in the meantime, computer users will continue to download and share encryption software. Some may even send a few copies overseas illegally. Whether all Americans will be forced to pay a steep political and economic price for the borderless geography of cyberspace remains to be seen. As McCain himself said, "Not everything in this country is free." ■ ■ ■

Message: 52
Date: 10.1.97
From: <nicholas@media.mit.edu>
To: <lr@wired.com>
Subject:

On Digital Growth and Form

Being digital has three physiological effects on the shape of our world. It decentralizes, it flattens, and it makes things bigger and smaller at the same time. Because bits have no size, shape, or color, we tend not to consider them in any morphological sense. But just as elevators have changed the shape of buildings and cars have changed the shape of cities, bits will change the shape of organizations, be they companies, nations, or social structures.

We understand, for example, that doubling the length of a fish multiplies its weight no less than eight times. We know that suspension cables break after a certain length because they cannot support their own weight. We are almost clueless, however, about the fractal nature of the digital world and how it will change the shape of our environment. Yet the effect will be no less substantial than if we changed the force of gravity.

Governance should be pushed down into the village and up onto the planet.

ORIGINAL PHOTO: STEVE DOUBLE

Cyberspace is not a tree

The most astonishing part of the Net is that nobody is in charge. Everybody knows this, but nobody really wants to believe it. The buck must stop somewhere. Surely somebody is in control. After all, football teams have captains, and orchestras have conductors. In fact, we take for granted some form of authority, some hierarchy, in almost everything. In childhood it comes from parents and teachers. In adult life it comes from bosses and government. While we may not always be pleased with where we stand in that hierarchy, at least we understand it.

But sometimes the mere presence of a police car can cause traffic jams. The Net – a reliable system composed of loosely connected and imperfect parts that work *because* nobody is in control – shakes up all our centralist notions, and hierarchy goes away by example.

Cyberspace is a lattice. If a part doesn't work, you go around it. The look and feel is suddenly much more biological, taking its character more from flora and fauna than from the unnaturally straight-line geometry in artifacts of human design. Picture the loose-V formation of ducks flying south.

But ducks don't run banks

Yes, many pieces of our world – work and play – do have a centralism to them. Hierarchy has its place. But even the most conservative centralist will agree that organizations have flattened, with considerably fewer levels between top and bottom. Mitsubishi Trading Company, for example, summarily removed an entire level of middle managers, and other firms are doing the same. In part this is due to a competitive market economy that demands streamlining. But in greater part it is because modern communications allow people to deal with more than seven others (plus or minus one).

Add current-day management doctrine and you get even thinner social forms. Leaders distinguish themselves by what they do, not by where they sit – something which many politicians and industrialists have yet to note. The computer industry learned this with open systems, where competing with imagination proves far more profitable than doing so with locks and keys.

A libertarian view of the world adds flatness to decentralism and concludes that large organizations, like the nation-state, are doomed. This is only half true. Instead I would liken the digital world to indigenous architecture, where local and global forces make for individualism and harmony at the same time. Each house on a Greek island is totally its own design, reflecting the ad hoc needs of various individuals over time. But common use of local materials – building in stone and applying whitewash to reflect the heat – results in a collective order. As soon as you use steel and air-conditioning, however, the only way to protect that harmony is to legislate it, relying on zoning laws to do what nature did before.

Bigger and smaller at the same time

My gripe with the nation-state is that it is just the wrong size – it does not mesh with the digital form of the future. Most nations are too big to be local, and all nations are too small to be global. What the Net is doing is forcing all of us into a body of law we do so badly – international law. Law of the sea, nonproliferation treaties, and trade agreements take forever to negotiate and are hard to maintain because nobody's primary self-interest is that of the world as a whole.

As soon as there is a means and mind-set to be global, governance should be pushed down into the village and up onto the planet. We see this happening to a limited extent if we look simultaneously at the business and political worlds. Economic forces are pushing toward a regionalization of commerce, and political forces are tending toward the breakup of nations. Bigger and smaller.

Businesses will do the same. Companies like Time Inc., News Corp., and Bertelsmann keep getting bigger and bigger. People worry about control of the world's media being concentrated in so few hands. But those who are concerned forget that, at the same time, there are more and more mom-and-pop information services doing just fine, thank you very much.

The value of being big is twofold: size affords organizations the ability to deal with worldwide physical space and the ability to lose lots of money in order to make a lot more. The value of being small needs no explanation.

At this point in history, it is hard to imagine that our highly structured and centralist world will morph into a planetful of loosely connected physical and digital communities. But it will. For this reason, more and more attention needs to be paid to just how and how well we can coordinate this new mass individualization. It is, for example, easy to see who will build the road in my village. It is considerably harder to see who will connect our villages, especially if some have less wealth or control than others. It is also hard to see how we will agree on various standards. Think of it – we live in a world where we cannot even agree on which side of the road to drive. ■ ■ ■

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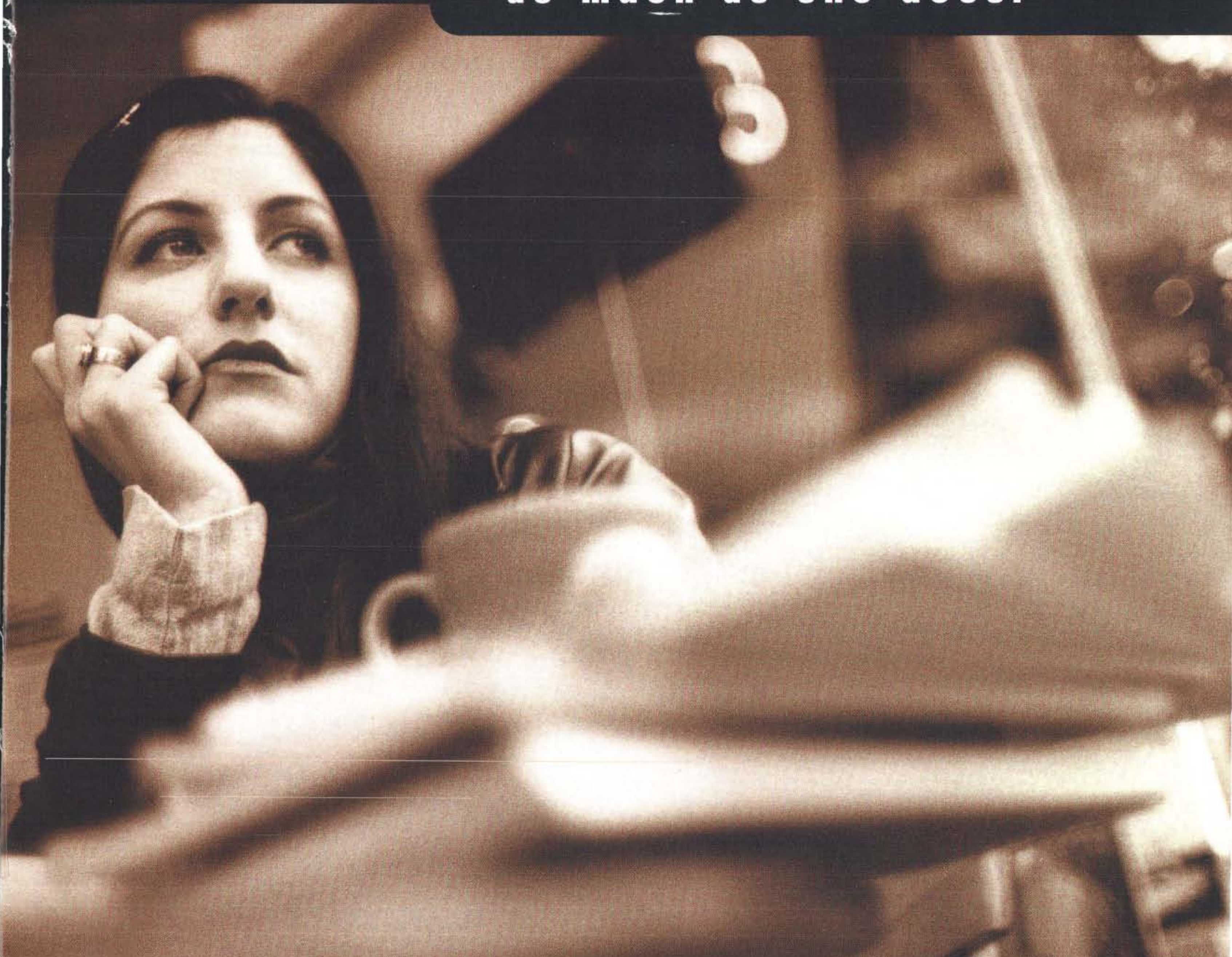

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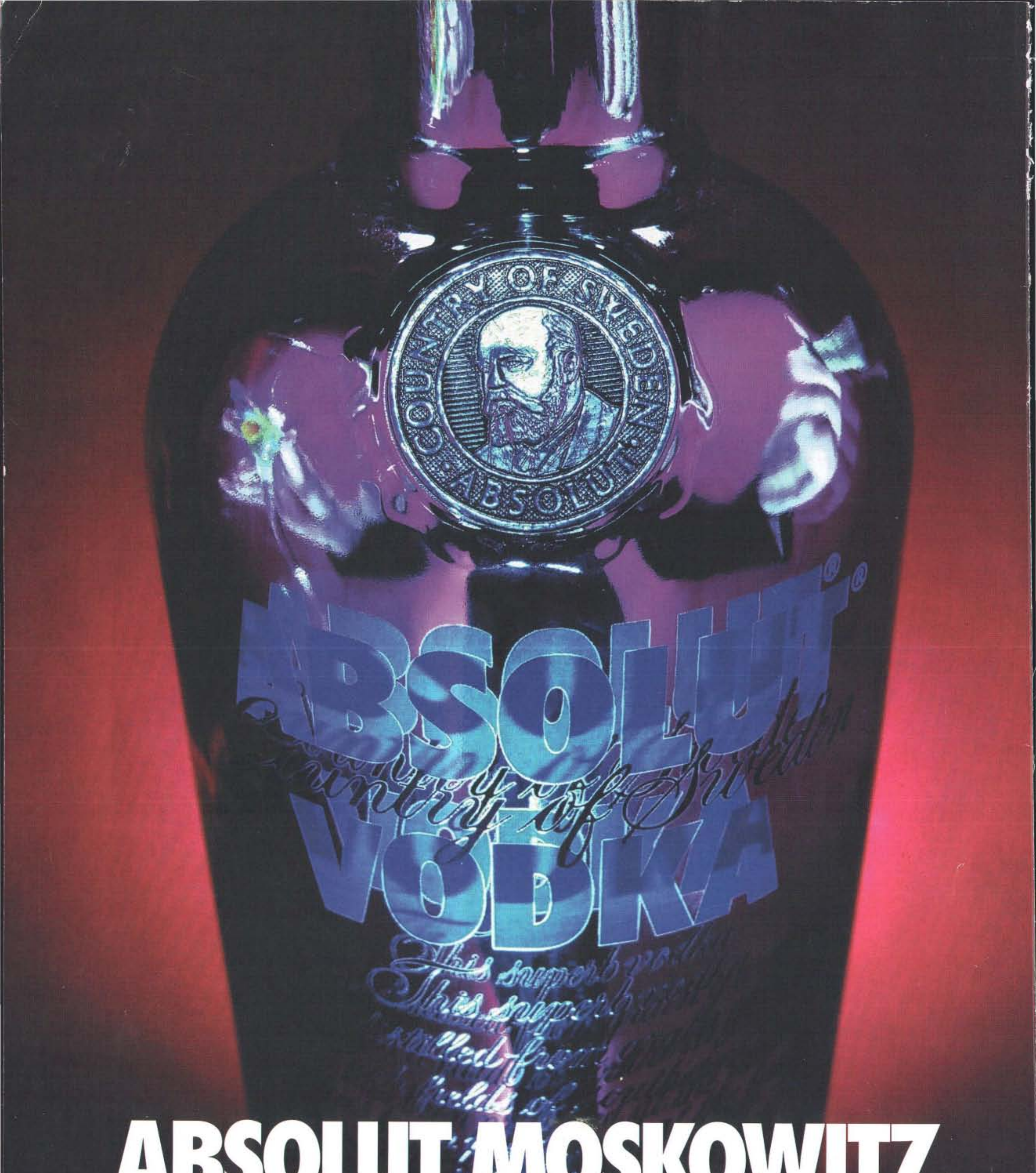

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